

PRACTICE EXAM 12: ASE A1 ENGINE REPAIR SIMULATION (50 QUESTIONS)

1. A technician is diagnosing a V8 engine with a persistent rough idle and a single-cylinder misfire code (P0308, cylinder 8). The spark plug, ignition coil, and fuel injector have all been swapped with adjacent cylinders and the misfire remains on cylinder 8. A compression test shows cylinder 8 at 148 PSI while all others range from 152 to 160 PSI. The specification minimum is 140 PSI. A leak-down test on cylinder 8 shows 10% leakage with faint air at the oil filler cap. Which of the following is the MOST likely cause of the persistent misfire?

- A. The 10% leak-down confirms severe ring wear on cylinder 8 that is causing the idle misfire
- B. A head gasket failure between cylinder 8 and an adjacent coolant passage is diluting the charge
- C. The compression and leak-down readings are normal and the misfire source is not engine mechanical
- D. The combination of marginally lower compression and minor ring leakage is enough to cause an idle-only misfire on this specific cylinder

2. A customer complains that the engine loses power gradually during sustained highway driving and the power returns after the vehicle sits for 15 minutes with the engine off. There are no codes and the engine idles normally. A vacuum gauge shows 18 in. Hg at idle. When the engine is held at 2,500 RPM for 60 seconds, the vacuum drops from 18 to 11 in. Hg progressively. Which of the following is the MOST likely cause?

- A. Worn piston rings that lose their seal progressively under sustained high-RPM operation
- B. A failing fuel pump that gradually loses output pressure during sustained high-demand periods
- C. A restricted catalytic converter that progressively traps exhaust gas and builds back-pressure
- D. A head gasket breach that worsens as the engine reaches full operating temperature under load

3. A technician removes a cylinder head from an inline-4 engine for a head gasket replacement. Before removing the head bolts, the technician notices that two of the twelve bolts turn freely with almost no resistance during the first two turns of loosening. All other bolts require normal breakaway torque. Which of the following BEST explains why these two bolts were loose?

- A. The bolts were not properly torqued during the previous head gasket installation or service event
- B. The two bolts are a different material grade than the others and relaxed from thermal cycling
- C. The block threads in those two holes have stripped and can no longer hold the bolt clamping force
- D. Thermal expansion of the aluminum head around those bolt locations loosened them over time

4. A V6 engine exhibits a vacuum gauge reading that oscillates slowly between 14 and 21 in. Hg at idle in a repeating wave pattern that takes approximately 5 seconds per cycle. No single cylinder appears to dominate the oscillation when a stethoscope is used. Compression is within specification on all cylinders. Which of the following is the MOST likely cause?

- A. Multiple burned valves on different cylinders producing an additive fluctuation pattern
- B. An intake manifold gasket with an intermittent leak that cycles between sealing and leaking
- C. A worn camshaft with two or three lobes below specification creating an uneven firing pattern
- D. A restricted PCV system that causes periodic crankcase pressure buildup that interrupts idle

5. A technician is rebuilding an engine that had a catastrophic rod bearing failure on cylinder 3. The number 3 rod journal is severely scored and heat-discolored. During disassembly, the technician also finds fine metallic debris embedded in the oil filter media and deposited on the oil pickup screen. Which of the following additional inspections is MOST critical before reassembly?

- A. Inspect all spark plug electrodes for metallic debris contamination from the oil system breach
- B. Inspect the catalytic converter for damage from metal particles that may have exited the exhaust
- C. Inspect the cylinder bores for scoring from debris that may have circulated through the oil system
- D. Inspect every bearing surface in the engine and flush every oil gallery to remove circulated debris

6. Technician A says that the oil pressure relief valve limits maximum system pressure by diverting excess oil back to the pan or pump inlet when pressure exceeds the valve's spring setting. Technician B says that without the relief valve, the oil pressure would continue to rise with RPM until seals and gaskets were blown out. 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

7. A customer reports that the engine temperature gauge slowly climbs above normal over a 30-minute drive and then drops back to normal for 10 minutes before climbing again. The pattern repeats indefinitely. Coolant level is correct. No codes are stored. The cooling fan operates when commanded by the scan tool. Which of the following is the MOST likely cause?

- A. A water pump with an intermittently slipping impeller that alternately circulates and fails to move coolant
- B. A failing ECT sensor that drifts out of calibration when heat-soaked and recovers when coolant cools it
- C. A thermostat that sticks intermittently — alternating between closed (temperature rises) and open (temperature drops)
- D. A partially clogged radiator that overheats under thermal load and cools when traffic airflow increases

8. A technician is measuring the connecting rod side clearance on a rebuilt engine. The feeler gauge reads 0.018 inches. The specification is 0.006 to 0.014 inches. Which of the following is the MOST likely consequence of this excessive side clearance?

- A. The connecting rod will overheat from friction against the crankshaft cheek at all engine speeds
- B. The excessive clearance will produce a knocking noise and may cause the rod to shift and contact the crank counterweight
- C. The piston will rotate in the bore because the rod has too much lateral freedom on the journal
- D. Oil pressure will drop significantly because oil escapes laterally from the rod bearing at a higher rate

9. A vehicle with a 2.4L four-cylinder engine and a timing chain-driven DOHC system develops a check engine light with codes P0016 (camshaft/crankshaft correlation bank 1) and P0341 (camshaft position sensor range/performance). The engine has 130,000 miles with oil changes every 5,000 miles using the specified full synthetic. Which of the following should the technician investigate FIRST?

- A. Timing chain stretch that has altered the base relationship between the camshaft and crankshaft sensors
- B. The VVT oil control valve for clogging because the codes indicate cam timing is out of the expected range
- C. A failed CMP sensor that is sending incorrect position data that does not correlate with the CKP signal
- D. The PCM programming because a software glitch may be misinterpreting the correlation between sensors

10. A technician is performing a block test (combustion leak test) on an engine suspected of a head gasket failure. The test fluid remains blue at idle. The technician then has an assistant hold the RPM at 3,000 while the technician repeats the test. The fluid changes from blue to yellow within 15 seconds. Which of the following is the correct interpretation?

- A. The block test is invalid at elevated RPM because exhaust fumes can contaminate the test fluid
- B. The engine has a severe exhaust leak that is producing hydrocarbons that are reaching the coolant
- C. The head gasket has a breach that leaks combustion gas into the coolant only under higher cylinder pressures
- D. The coolant has been contaminated with a chemical that reacts with the test fluid only at higher temperatures

11. A rebuilt engine develops a rhythmic clunking noise from the lower block area within the first 50 miles of operation. The noise is present at idle and increases with RPM. Oil pressure is 20 PSI at idle — below the 25 PSI minimum specification. The technician verified all bearing clearances with Plastigage during assembly. Which of the following is the MOST likely cause of the premature failure?

- A. The Plastigage readings were correct but the bearing shells were installed without assembly lubricant
- B. The oil gallery cleaning was inadequate and debris damaged a bearing surface shortly after startup
- C. The new bearing shells were defective and had incorrect wall thickness from a manufacturing error
- D. The oil pump was installed with the drive gear one tooth off, reducing its output at all engine speeds

12. Technician A says that when removing spark plugs from an aluminum cylinder head, the engine should be warm — not cold — to reduce the risk of stripping threads. Technician B says that spark plugs

in aluminum heads should be removed when the engine is cold because the aluminum contracts and releases the plug. Who is correct?

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

13. A technician is testing a vehicle's charging system after replacing the alternator. With the engine running at 2,000 RPM and all accessories on (headlights, blower, rear defogger), the voltmeter across the battery terminals reads 13.2 volts. With all accessories off at the same RPM, the reading rises to 14.4 volts. The specification is 13.5 to 14.8 volts. Which of the following is the correct interpretation?

- A. The alternator is defective because it cannot maintain minimum voltage under full accessory load
- B. The battery is deeply discharged and is pulling the voltage down during the high-demand accessory test
- C. The alternator output is marginal — it meets specification unloaded but drops below minimum under full load
- D. The voltage drop under load is normal because all charging systems reduce output when demand increases

14. A customer complains that the engine has developed a loud, continuous hissing noise from the engine compartment that varies with engine RPM. The noise was not present last week. A visual inspection reveals no disconnected hoses. The engine idles roughly with long-term fuel trim at plus 18% on both banks. Which of the following is the MOST likely cause?

- A. A crack in the exhaust manifold that produces a hissing noise under the pressure of exhaust flow
- B. A serpentine belt that is beginning to delaminate and producing a hissing sound against the pulleys
- C. A torn PCV valve diaphragm that is creating noise as crankcase gases rush through the torn area
- D. A significant vacuum leak from a cracked intake manifold or large disconnected vacuum line

15. A technician is performing an engine oil change and discovers that the oil drained from the engine has a distinct silver-metallic shimmer throughout the entire volume — not just a few particles, but a pervasive glitter throughout all five quarts. The customer has no performance complaints and the engine sounds normal. Which of the following is the MOST appropriate action?

- A. Add an oil additive with extreme-pressure compounds to protect the wearing bearing surfaces
- B. Perform an oil pressure test, cut open the oil filter for inspection, and advise the customer of the finding
- C. Continue with the oil change and recheck at the next service in 5,000 miles for progression
- D. Immediately disassemble the engine because pervasive metallic content confirms bearing failure

16. A V8 engine with hydraulic roller lifters produces a ticking noise from the valvetrain area that is present at all times but becomes significantly louder when the engine oil temperature reaches full operating temperature. The noise diminishes slightly when the engine cools back down to warm. Oil level is correct and oil pressure is within specification at all temperatures. Which of the following is the MOST likely cause?

- A. A hydraulic lifter with a worn internal check valve that bleeds down faster as oil thins with temperature
- B. A worn camshaft lobe that produces more noise as the engine block expands at operating temperature
- C. A lifter bore in the block that has enlarged from wear and allows the lifter to tilt as oil thins at temperature
- D. A rocker arm with a worn pivot that develops more play as the oil lubricating the pivot becomes thinner

17. A four-cylinder engine with 200,000 miles is brought in for evaluation. The technician performs a comprehensive diagnostic: compression is uniformly low at 110 to 118 PSI (specification 145–165), wet test improves all cylinders 20 to 25 PSI, vacuum is a steady 14 in. Hg at sea level, oil pressure is 15 PSI at hot idle (specification minimum 10), oil consumption is one quart per 1,500 miles, and the engine does not knock. The customer asks whether the engine should be rebuilt. Which of the following is the MOST accurate assessment?

- A. The engine is worn throughout but all critical parameters remain above minimum specification and the decision to rebuild depends on the customer's tolerance for continued decline

- B. The engine requires immediate rebuilding because compression is below specification and will fail soon
- C. The engine is in acceptable condition because oil pressure and vacuum are within specification
- D. The engine should be replaced rather than rebuilt because the extent of wear makes rebuilding uneconomical

18. A technician is diagnosing an intermittent overheating condition that occurs only when the vehicle is stopped in traffic with the engine idling. The temperature returns to normal the moment the vehicle begins moving. All cooling system components have been tested and found functional during shop testing — the fan comes on, the thermostat opens, coolant level is correct, and the system holds pressure. Which of the following is the MOST likely explanation for why the problem cannot be reproduced in the shop?

- A. The ambient temperature in the shop is cooler than the conditions when the vehicle overheats in traffic
- B. The shop testing was performed at a higher idle speed than the engine actually idles in traffic conditions
- C. The vehicle's aerodynamic underbody panels trap heat when stationary in traffic that dissipates in the shop
- D. The overheating occurs only when the engine has been running at highway speed and then stops — the residual heat load exceeds what can be reproduced by idling in the shop from a cold start

19. A technician discovers that during an engine rebuild, one of the new piston cooling jets (oil squirters) does not spray when the oil system is pre-primed. The other three jets spray a consistent stream. The blocked jet's nozzle appears clean when visually inspected from the outside. Which of the following is the MOST likely cause?

- A. The oil gallery supplying that cylinder's jet has a blockage from debris left during block cleaning
- B. The jet has an internal manufacturing defect that blocks the oil passage within the jet body itself
- C. The oil pump is not generating enough pressure to activate all four jets simultaneously during priming
- D. The jet was installed at an incorrect angle and the oil stream is hitting the bore wall instead of spraying free

20. Technician A says that an engine block with a crack between a cylinder bore and a coolant passage should typically be replaced rather than repaired. Technician B says that engine block cracks can always be reliably repaired by welding or cold-metal stitching regardless of location. Who is correct?

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

21. A customer brings in a vehicle after driving through a deep puddle. The engine died immediately after the front of the vehicle submerged briefly. The engine will not crank — the starter clicks but the crankshaft does not rotate. The battery is fully charged. Which of the following should the technician check FIRST?

- A. Remove the spark plugs and attempt to crank the engine to check for water ingestion into the cylinders
- B. Check the starter motor for water damage that is preventing the armature from rotating properly
- C. Inspect the air filter and air intake tract for evidence of water that was drawn into the engine
- D. Perform a voltage drop test on the starter circuit to check for water-damaged wiring connections

22. A technician is measuring the bore diameter on a cylinder that was bored 0.020 inches oversize during a previous rebuild. The bore now measures 3.8220 inches. The original standard bore was 3.8000 inches. The 0.020-oversize specification should have measured 3.8200 inches. The manufacturer allows a maximum of 0.002 inches of taper. Current taper measured in this bore is 0.0020 inches. Which of the following is the correct assessment?

- A. The bore has worn only 0.002 inches beyond the 0.020-oversize dimension and can be honed with 0.020 rings
- B. The bore must be bored to 0.030-inch oversize because it has worn 0.0020 inches beyond the previous oversize
- C. The bore is within the original standard specification and can be returned to standard with a hone
- D. The bore must be bored to 0.030-inch oversize because the taper of 0.002 inches equals the maximum specification and the bore has worn to 3.8220 — 0.002 beyond the previous oversize dimension

23. A technician performs a cranking vacuum test on a four-cylinder engine that will not start. The vacuum gauge shows a consistent 2 in. Hg during cranking, which is within the normal cranking vacuum range. The engine has spark and fuel but will not fire. Compression test results are: Cyl 1 = 45, Cyl 2 = 50, Cyl 3 = 48, Cyl 4 = 42 PSI. Which of the following BEST reconciles the normal cranking vacuum with the very low compression readings?

- A. The vacuum gauge is malfunctioning and not reading accurately during the cranking test sequence
- B. The low compression is caused by ring wear that allows enough air movement to produce vacuum
- C. The valve timing is slightly off — enough to dramatically reduce compression but still allow some cylinder filling that produces cranking vacuum
- D. The engine has a restricted exhaust that is preventing compression from building to normal levels

24. A customer reports that the engine oil level drops one quart every 800 miles. There are no visible external leaks. The exhaust shows no visible smoke at any operating condition. The PCV system is functioning correctly. Compression and leak-down tests are within specification. The vehicle has a functioning catalytic converter. Which of the following BEST explains how the engine can consume a quart of oil per 800 miles with no visible smoke?

- A. The oil is being consumed through the intake valve guides at a rate too slow to produce visible smoke
- B. The catalytic converter oxidizes the oil vapor in the exhaust before it exits the tailpipe as visible smoke
- C. The oil is being lost through a pinhole leak that evaporates before reaching the ground surface
- D. The PCV system is recycling oil vapor back into the intake at a rate that exceeds the test's detection

25. A technician is inspecting a crankshaft removed from a high-mileage engine. All main journal measurements are within standard specification. All rod journal measurements are within standard specification. The crankshaft passes Magnaflux inspection with no cracks detected. However, the fillet radii on three of the rod journals show slight polishing marks — smoother and shinier than the unpolished fillet radii on the other journals. Which of the following is the correct interpretation?

- A. The polishing marks indicate the rod bearings were contacting the fillet radii from excessive bearing width or rod side clearance
- B. The polishing is a normal wear pattern and does not affect the structural integrity of the crankshaft

- C. The polished fillets indicate the crankshaft was previously reground and the fillets were over-polished
- D. The crankshaft should be replaced because any fillet contact creates a stress riser that leads to fatigue cracking

26. An engine with a single overhead cam and a hydraulic timing chain tensioner develops a brief rattle at startup that has been gradually getting longer over the past six months. Initially it lasted one second; it now lasts four seconds. Oil level and pressure are within specification. Oil changes are performed at the correct interval with the specified oil. Which of the following components is MOST likely wearing and allowing the progressive increase in startup rattle duration?

- A. The timing chain itself, which stretches with age and creates more slack for the tensioner to take up
- B. The camshaft sprocket teeth, which wear and change the chain's engagement pattern at each startup
- C. The oil pump, which takes progressively longer to build pressure due to internal gear wear over time
- D. The hydraulic tensioner's internal check valve and seals, which leak oil faster as they wear and allow more drain-down overnight

27. A rebuilt engine exhibits a condition where oil pressure reads 60 PSI at cold startup, drops to 25 PSI as the engine warms to operating temperature, and then reads 55 PSI at 2,500 RPM once warm. The specification is 20 PSI minimum at hot idle and 40 to 65 PSI at speed. All readings are within specification. The customer is concerned about the large drop from cold to hot idle. Which of the following is the correct explanation?

- A. The oil pump relief valve is sticking intermittently and failing to regulate pressure during warm-up
- B. Cold oil is thick and resists flow through bearing clearances, producing high pressure that drops as the oil thins to operating viscosity
- C. The bearing clearances are on the loose side of specification and only become apparent when oil thins
- D. The oil filter bypass valve is opening prematurely as oil temperature rises and viscosity decreases

28. A technician is diagnosing a vehicle that consistently fails an emissions test for high hydrocarbon (HC) readings. The engine runs smoothly with no misfires, no codes, and normal compression. The catalytic converter is relatively new and was verified as functional. The spark plugs are new and correctly gapped. Which of the following engine-related conditions could still cause high HC emissions despite these normal findings?

- A. Retarded ignition timing that slows the combustion process and allows unburned fuel to exit the cylinder
- B. A restricted exhaust system that prevents exhaust gas from reaching the catalytic converter efficiently
- C. A slight vacuum leak that creates a marginally lean condition resulting in incomplete combustion on every cycle
- D. Excessive exhaust valve stem-to-guide clearance that allows oil to seep into the exhaust port post-combustion

29. An engine block is being inspected during a rebuild. The technician discovers that the number 4 cylinder has a dark, discolored band around the bore at the exact height where the top compression ring sits at TDC. The discoloration is uniform around the circumference and does not feel rough. Above this band (in the ridge area) the bore is the original machined finish. Below the band, the bore shows normal wear patterns. Which of the following BEST describes what caused this discolored band?

- A. This is the carbon ridge line where combustion gases have stained the bore at the upper limit of ring travel
- B. The discoloration is from a coolant leak that seeped into the bore at the head gasket interface level
- C. The band marks the location where the top ring scuffed the bore from insufficient lubrication at TDC
- D. The dark band is caused by heat discoloration from detonation damage concentrated at the top of the bore

30. A technician is investigating a complaint that the engine temperature gauge fluctuates rhythmically between normal and slightly above normal during highway driving. The coolant level is correct. The system holds pressure. A block test is negative. The technician removes the thermostat and bench-tests it — it opens at 195°F and fully opens at 215°F, both within specification. Which of the following should the technician investigate NEXT?

- A. The radiator for internal restriction that could cause intermittent flow impedance through certain tubes
- B. The ECT sensor for an intermittent electrical connection that causes momentary signal spikes
- C. The head gasket for a minor breach that produces intermittent gas pockets in the coolant flow path
- D. The cooling system for trapped air that circulates past the temperature sensor causing periodic readings

31. A technician discovers during a valve job that one exhaust valve seat insert has cracked into two pieces and one piece has partially dislodged from the head. The head is aluminum with pressed-in hardened steel seat inserts. Which of the following repair steps must be performed in the correct sequence?

- A. Install a new valve on the cracked seat and rely on the valve spring pressure to hold both pieces in place
- B. Lap the cracked seat with extra compound to restore a seal between the fractured seat halves
- C. Remove the cracked seat insert, inspect the bore for damage, install a new insert, and then cut the new seat
- D. Weld the cracked seat in place to prevent further movement and then recut the seat to specification

32. A customer's vehicle has been diagnosed with an internal coolant leak. The technician has confirmed a head gasket breach between the number 3 combustion chamber and a coolant passage using a positive block test and a compression test showing cylinder 3 significantly lower than the others. During the repair, the technician should perform all of the following EXCEPT:

- A. Check the block deck surface for warpage with a straightedge and feeler gauge set
- B. Reuse the existing head bolts if they appear to be in good condition and are not TTY design
- C. Inspect the cylinder head for cracks using dye penetrant or pressure testing before resurfacing
- D. Flush the cooling system to remove any contamination from the gasket failure before refilling

33. A technician is testing the oil pressure on a freshly rebuilt V6 engine. At hot idle, the gauge reads 30 PSI. At 2,500 RPM, the gauge reads 30 PSI — exactly the same. The specification is 20 PSI minimum at idle and 40 to 65 PSI at speed. Which of the following BEST explains why the pressure does not increase with RPM?

- A. The oil pump is functioning correctly but all bearing clearances are at maximum specification
- B. The oil filter is so restricted that it limits flow regardless of how much the pump outputs at speed
- C. All bearing clearances are so tight that oil has nowhere to go and pressure plateaus at 30 PSI
- D. The oil pressure relief valve is stuck partially open, capping maximum pressure at 30 PSI regardless of RPM

34. A technician is evaluating a DOHC cylinder head for a valve job. After removing all valves and cleaning, the technician discovers that three of the eight exhaust valve guides are worn beyond specification while all eight intake guides are within specification. The customer wants to minimize the repair cost. Which of the following is the MOST appropriate repair scope?

- A. Repair or replace only the three worn exhaust guides and install new exhaust valve stem seals on all eight valves
- B. Repair all eight exhaust guides because the remaining five will likely wear to the same point soon
- C. Replace all sixteen guides (intake and exhaust) because guide wear is a systemic condition
- D. Replace only the exhaust valve stem seals on the three worn guides without repairing the guides

35. A vehicle with a turbocharged engine develops a P0234 (turbo overboost condition) code. The customer reports that the engine feels more powerful than normal during acceleration. The scan tool shows peak boost reaching 22 PSI when the specification is 17 PSI maximum. Which of the following is the MOST likely cause?

- A. A restricted intercooler that is trapping compressed air and causing pressure to build excessively
- B. An exhaust leak before the turbine that is reducing turbine efficiency and causing the turbo to overcompensate
- C. A wastegate that is stuck closed or a wastegate actuator that is not opening to relieve boost pressure
- D. A faulty boost pressure sensor that is reading lower than actual and not triggering the overboost protection

36. Technician A says that cylinder bore glaze must be removed by honing before installing new piston rings. Technician B says that new rings can seat against a glazed bore if the break-in procedure generates sufficient cylinder pressure. 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

37. An engine has been diagnosed with a single burned exhaust valve on cylinder 2 of an inline-4 engine. The head is removed and the technician confirms the burned valve. During the repair, the technician should also inspect all of the following EXCEPT:

- A. The valve seat in the number 2 exhaust position for erosion or damage from the burned valve
- B. The valve guide in the number 2 exhaust position for wear that may have contributed to the failure
- C. All remaining valves and seats for signs of developing problems that should be addressed now
- D. The connecting rod bearing on cylinder 2 for heat damage caused by the burned valve condition

38. A technician is diagnosing a noise complaint. The engine produces a loud, deep knocking sound at idle. When the oil pan is removed for inspection, the technician observes that the number 2 connecting rod big-end cap is visibly loose — one of the two rod bolts has backed out approximately three turns. The bearing surfaces show minor scoring but the journal appears undamaged. Which of the following is the MOST appropriate repair?

- A. Retorque the loose bolt and reassemble the engine after verifying the bearing clearance is acceptable
- B. Replace the number 2 connecting rod bolts, install new bearing shells, verify the clearance, and check the journal
- C. Replace the entire crankshaft because the loose cap has likely caused microscopic journal damage
- D. Replace all connecting rod bolts and bearings in the engine as a precaution against similar failures

39. A technician is investigating a vehicle that has had three alternators fail within one year. Each alternator tested defective at the time of replacement. The battery tests good each time. The serpentine belt and tensioner have been replaced. There are no parasitic draw issues. Which of the following should the technician investigate as a possible root cause of the repeated alternator failures?

- A. The battery cable gauge is undersized for the vehicle's electrical demand and is overloading the alternator
- B. An aftermarket audio system or accessory that draws more current than the alternator can sustain continuously
- C. A voltage drop in the charging circuit that causes the alternator to work harder to maintain target voltage
- D. The engine vibrates at a resonant frequency that causes premature alternator bearing failure

40. A technician discovers that an engine has been assembled with conventional (non-TTY) head bolts that are 0.25 inches shorter than the specification for the bolt holes they were installed in. The engine has been running for 2,000 miles with no symptoms. Which of the following is the MOST significant risk from this condition?

- A. The shorter bolts have fewer threads engaged in the block, reducing clamping force and risking head gasket failure under load
- B. The shorter bolts are bottoming out in the holes and producing a false torque reading that appears correct
- C. The shorter bolts have created a vacuum between the bolt end and the bottom of the hole that may pull coolant in
- D. The shorter bolts will cause the cylinder head to warp unevenly because the clamping force is not distributed

41. A technician is diagnosing an engine that runs perfectly at operating temperature but produces a heavy misfire on cylinders 1 and 4 during the first 90 seconds of cold start. After 90 seconds, the misfire clears completely and does not return. Compression on all cylinders is within specification when tested at operating temperature. Ignition and fuel components have been verified as functional. Which of the following is the MOST likely cause?

- A. Worn valve guides on cylinders 1 and 4 that allow excessive oil to foul the plugs during cold soak
- B. Carbon buildup on the intake valves of cylinders 1 and 4 disrupting fuel atomization when cold
- C. Head gasket breaches at cylinders 1 and 4 that only leak when the head is cold and contracted
- D. Cold-start fuel enrichment that is excessive on cylinders 1 and 4 due to injector flow imbalance

42. A technician removes the valve cover from an OHC engine during a routine gasket replacement and notices that one of the exhaust camshaft lobes appears visibly rounded compared to the sharp, pointed profile of all the other lobes. The engine has 175,000 miles. The customer has no performance complaints. Which of the following is the MOST appropriate action?

- A. Measure the lobe lift on the rounded lobe and compare it to specification before making a repair recommendation
- B. Replace the exhaust camshaft immediately because a visibly rounded lobe confirms a failure in progress

C. Install the new valve cover gasket and do not mention the lobe because the customer has no complaints

D. Replace all exhaust valve lifters on that bank because a worn lobe indicates the lifters are also worn

43. A technician is performing an oil consumption test on a customer vehicle. The oil was changed, filled to the exact full mark, and the customer returned at exactly 1,000 miles. The oil level is now at the low mark on the dipstick — approximately one quart below full. The manufacturer considers up to one quart per 1,000 miles normal. However, the customer previously owned the same model vehicle and it consumed no measurable oil in 1,000-mile intervals. Which of the following is the correct response?

A. The engine has abnormal oil consumption because no oil consumption at all is the expected standard

B. Recommend an engine rebuild because the customer's previous experience proves this engine is defective

C. Explain that the consumption is within the manufacturer's specification while acknowledging the customer's concern

D. Switch to a heavier viscosity oil to bring the consumption below the detectable threshold for this customer

44. A technician is performing a compression test and notices that when cranking cylinder 3, the compression gauge needle bounces erratically rather than climbing smoothly with each stroke. The final reading is 140 PSI, which is within specification, but the needle behavior is different from all other cylinders where the needle climbed smoothly in even increments. Which of the following could cause this erratic needle behavior on cylinder 3?

A. A sticky valve on cylinder 3 that intermittently hangs open and then reseats during different strokes

B. A cracked piston ring on cylinder 3 that seals inconsistently as the ring fragments shift position

C. Normal variation in cranking speed caused by the starter motor's brush contact pattern rotating

D. An air leak in the compression gauge hose adapter that affects readings only on specific cylinders

45. An engine block has been cleaned, inspected, and passed crack detection testing. The technician is installing freeze plugs as part of the reassembly. One of the freeze plug bores has a small raised burr of metal on the inner edge from a previous plug removal. Which of the following is the correct action before installing the new plug?

- A. Remove the burr with a file or die grinder to ensure the new plug seats flat and seals completely
- B. Install the plug over the burr because the press-fit installation force will flatten the burr automatically
- C. Apply silicone sealant over the burr area before installing the plug to fill the void created by the raised metal
- D. Drill the burr out and install an oversized plug to compensate for the material removed during cleanup

46. A technician is diagnosing a vehicle where the engine cranks normally but will not start after sitting for two weeks. The battery is fully charged. A spark test confirms spark is present. Fuel pressure at key-on reads 0 PSI, but after the pump runs for three seconds, pressure builds to 55 PSI (within specification). The engine starts and runs normally once pressure builds. Which of the following BEST explains the extended crank time after sitting for two weeks?

- A. The fuel pump motor has weakened and requires several seconds of run time to reach full speed output
- B. The fuel system lost all pressure during the two-week sitting period and the pump must repressurize the entire rail and lines before the injectors can deliver fuel
- C. The fuel has partially evaporated during the two-week sitting period and the remaining fuel has reduced volatility
- D. The spark plugs have fouled from fuel residue during the sitting period and require cranking to self-clean

47. A technician is rebuilding a high-performance engine and the customer has requested a camshaft with 0.050 inches more lift than the stock camshaft. The engine uses flat-tappet hydraulic lifters. Which of the following must be verified before the new camshaft is installed?

- A. That the oil pump can supply adequate volume for the increased lifter bore oil demand at higher lift
- B. That the hydraulic lifters have enough internal plunger travel to accommodate the increased lift without bottoming out
- C. That the valve springs have adequate pressure and travel to control the valves at the increased lift without coil bind
- D. That the rocker arm ratio is compatible with the increased lift so the pushrods do not exceed their buckling strength

48. A customer reports that the engine oil pressure gauge reads higher than normal at all times — 70 PSI at idle and 85 PSI at 2,500 RPM. The specification is 25 to 35 PSI at idle and 45 to 65 PSI at speed. The oil was recently changed. The engine shows no symptoms other than the high gauge reading. Which of the following is the MOST likely cause?

- A. The oil pump has been replaced with a high-volume pump that was not specified for this application
- B. The oil pressure sending unit has failed and is giving a false high reading to the dashboard gauge
- C. The oil filter installed during the recent change is too restrictive and is creating excessive system pressure
- D. The oil pressure relief valve is stuck closed and is not diverting excess oil to limit maximum system pressure

49. A technician is evaluating an engine that has been running with a severe coolant leak for an extended period. The customer continued driving despite the overheating warning. Upon inspection, the engine oil is a thick, gray-green sludge that resembles mayonnaise. The coolant recovery tank is empty. Which of the following is the MOST critical concern about this engine's internal condition?

- A. The coolant-contaminated oil has likely destroyed the bearing surfaces throughout the engine from glycol attack
- B. The overheating has warped the crankshaft and the crankshaft must be checked for straightness
- C. The cylinder walls have likely been scored from thermal expansion of the pistons during overheating
- D. The timing chain has likely stretched from the extreme heat and must be replaced before further evaluation

50. A technician is performing a final quality check on a rebuilt engine before delivery. The engine has been run through three heat cycles with no leaks, normal oil pressure, normal compression, and a negative block test. The customer asks what single test provides the MOST comprehensive verification that the engine rebuild was successful. Which of the following is the correct answer?

- A. A cylinder leak-down test on all cylinders because it quantifies the sealing ability of every cylinder
- B. A thorough road test under varied conditions — cold start, warm-up, idle, cruise, acceleration, deceleration, and hill climbing — because it exercises all engine systems under real-world operating loads

C. An oil analysis sent to a laboratory because it detects microscopic wear metals that indicate component condition

D. A dynamometer pull to verify the engine produces its rated horsepower and torque output specification

Practice Exam 12: Answer Key and Full Explanations

Domain Key: Each question's domain is noted in brackets for score tracking.

[A] = General Engine Diagnosis | [B] = Cylinder Head and Valve Train | [C] = Engine Block | [D] = Lubrication and Cooling Systems | [E] = Fuel, Electrical, Ignition, and Exhaust Systems

1. D — Cylinder 8 at 148 PSI meets the 140 PSI minimum and is within 10% of the highest cylinder, so it technically passes both thresholds. [A] However, the 10% leak-down with air at the oil filler cap confirms minor ring wear, and the compression is the lowest in the engine. At idle — where cylinder pressures are lowest — this marginally weaker cylinder may not maintain consistent combustion, producing an idle-only misfire that clears at higher RPM when increased cylinder pressure compensates for the ring wear. The ignition and fuel swap confirmed the cause is mechanical.

2. C — Power loss during sustained driving that recovers after a 15-minute rest, combined with vacuum that progressively drops from 18 to 11 in. Hg at sustained RPM, is the definitive pattern of a restricted exhaust — typically a clogged catalytic converter. [A] At idle, the low exhaust volume passes through the restriction. At sustained 2,500 RPM, exhaust accumulates behind the restriction faster than it can pass through, progressively building back-pressure that reduces engine breathing and power. The 15-minute rest allows the trapped pressure to bleed off, temporarily restoring performance.

3. A — Head bolts that turn freely with almost no breakaway resistance were not properly torqued during the previous installation. [B] Correctly torqued head bolts — whether conventional or TTY — require significant breakaway torque to loosen because they are clamped under tremendous preload against the gasket. Bolts that spin freely indicate they were never tightened to specification, which means those two bolt locations had insufficient clamping force on the gasket — a direct contributor to the gasket failure being repaired.

4. B — A vacuum reading that oscillates slowly in a large wave pattern (14 to 21 in. Hg over 5 seconds) without tracking any individual cylinder's firing rhythm suggests a systemic, periodic disturbance rather

than a single-cylinder valve or compression problem. [A] An intake manifold gasket with an intermittent leak — where the gasket material periodically seals and then reopens due to thermal movement or vibration — produces a cyclical vacuum variation that does not correspond to any single cylinder's events. The normal compression readings support this non-mechanical-failure explanation.

5. D — When a rod bearing fails catastrophically, it generates metallic debris that circulates through the entire oil system — main gallery, all bearing journals, cam bearings, and any component that receives pressurized oil. [D] The debris found in the filter and on the pickup screen confirms systemic contamination. Before reassembly, every bearing surface must be inspected for embedded debris damage, and every oil gallery must be thoroughly flushed until no contaminants remain. Reassembling without this comprehensive cleaning guarantees premature failure of another bearing.

6. A — Both technicians are correct. [D] Technician A accurately describes the relief valve's mechanical function: it is a spring-loaded valve that opens when system pressure exceeds the spring's calibrated setting, diverting excess oil back to the pan to cap maximum pressure. Technician B correctly identifies the consequence of not having this valve: the positive-displacement pump would continue to push more oil into a system that has finite leakage capacity, and pressure would rise uncontrolled until the weakest seal or gasket failed.

7. C — A temperature gauge that cycles between above-normal and normal in a repeating pattern is the hallmark of a thermostat that sticks intermittently. [D] When the thermostat sticks closed, coolant cannot flow to the radiator, and temperature rises. When it eventually breaks free and opens, coolant rushes to the radiator, temperature drops back to normal. The cycle repeats each time the thermostat sticks again. A consistently restricted radiator or failing sensor would produce a steady elevated temperature, not a rhythmic cycling pattern.

8. B — Connecting rod side clearance of 0.018 inches — 0.004 inches above the 0.014-inch maximum — means the rod has excessive lateral freedom on the crankshaft journal. [C] The rod can shift sideways far enough to produce an audible knocking sound as it contacts the crankshaft cheek on each revolution. In extreme cases, the lateral movement can bring the rod into contact with the crankshaft counterweight, causing accelerated wear on the rod, counterweight, and bearing. The rod or crankshaft must be corrected to bring side clearance within specification.

9. A — A P0016 (cam/crank correlation) combined with P0341 (CMP sensor range/performance) on a 130,000-mile engine with proper oil maintenance suggests the base timing relationship between the camshaft and crankshaft has changed — the most common cause is timing chain stretch. [A] A stretched chain alters the camshaft's rotational position relative to the crankshaft, and the CMP sensor reports a position that no longer correlates with what the PCM expects based on the CKP signal. The P0341 code

confirms the CMP signal is outside its expected range, which is consistent with a physically displaced camshaft.

10. C — A block test that is negative at idle but positive at 3,000 RPM confirms a head gasket breach that only leaks detectable amounts of combustion gas into the coolant under the higher cylinder pressures generated at elevated RPM. [A] At idle, cylinder pressures are relatively low and the small gasket breach may not force enough combustion gas into the coolant to change the test fluid. At 3,000 RPM, the significantly higher combustion pressures drive more gas through the breach, producing enough hydrocarbons in the coolant to trigger the color change.

11. B — A rebuilt engine that develops a bearing knock within 50 miles despite verified Plastigage clearances points to contamination from inadequate oil gallery cleaning. [C] Residual honing grit, machining debris, or cleaning chemical residue that was not fully flushed from the galleries was dislodged by fresh oil pressure on first startup, carried to a bearing, and embedded in the soft bearing material. The debris scoring rapidly enlarges the clearance, drops local oil pressure, and produces the knock. This is one of the most common causes of premature bearing failure after rebuilds.

12. A — Technician B only is correct: spark plugs in aluminum heads should be removed when the engine is cold. [E] Aluminum has a higher coefficient of thermal expansion than steel. When the engine is cold, the aluminum head contracts slightly around the steel plug threads, but the overall fit is more stable and predictable. When hot, the aluminum expands more than the steel plug, and the differential expansion can cause the threads to gall or seize, increasing the risk of stripping the aluminum threads during removal.

13. C — The alternator produces 14.4 volts with no load (within the 13.5–14.8 specification) but drops to 13.2 volts (below the 13.5 minimum) under full accessory load. [E] This indicates the alternator's output capacity is marginal — it can maintain specification voltage when demand is low but cannot sustain minimum voltage when all accessories are drawing maximum current simultaneously. The alternator may have a weak diode, worn brushes, or insufficient field current that limits its maximum output.

14. D — A loud hissing noise from the engine compartment that varies with RPM, appeared suddenly, and is accompanied by a rough idle with plus 18% fuel trim on both banks confirms a significant vacuum leak. [A] The elevated fuel trim on both banks means the PCM is adding 18% more fuel to compensate for unmetered air entering the intake. The hissing is the sound of air rushing through the breach under vacuum. A crack in the intake manifold or a large disconnected vacuum line are the most common sources of a leak this severe and sudden.

15. B — A pervasive metallic shimmer throughout the entire oil volume — not just isolated particles on the filter — indicates a significant quantity of metal is being generated internally. [D] While the engine sounds normal now, this level of metallic content is abnormal and warrants immediate investigation. An oil pressure test establishes whether bearing clearances are already compromised, and cutting open the filter reveals the particle size and type (bearing material, ring material, or gear debris) that identifies the source. The customer must be informed of the finding and its implications.

16. C — A hydraulic lifter tick that worsens at full operating temperature and diminishes when the engine cools slightly points to a lifter bore clearance issue that is temperature-dependent. [B] As the block reaches full operating temperature, thermal expansion may enlarge a worn lifter bore slightly, allowing the lifter to tilt in the bore. A tilted lifter cannot maintain proper alignment with the cam lobe, and the oil film at the lifter-bore interface becomes inconsistent. The thinner hot oil exacerbates the tilt by providing less hydraulic resistance. When the engine cools slightly, the bore contracts and stabilizes the lifter.

17. A — This is a high-mileage engine that is worn throughout but has not failed catastrophically — all critical parameters (oil pressure, vacuum) remain above their minimum specifications. [A] The compression is below specification but uniform, confirming generalized wear rather than a specific failure. The honest assessment is that the engine will continue to decline gradually — more oil consumption, less power, lower fuel economy — but is not in imminent danger of sudden failure. The rebuild decision is a quality-of-life and economic choice the customer makes with this information.

18. D — The key to this scenario is understanding that an intermittent overheating condition in traffic after highway driving involves a residual thermal load from highway operation. [D] At highway speed, the engine produces maximum sustained heat output. When the vehicle stops in traffic, the cooling system must dissipate the residual heat plus the ongoing idle heat — a greater total thermal load than can be reproduced by simply idling a cold engine in the shop. The shop test starts with a cool engine and never reaches the accumulated heat levels of the real-world scenario.

19. B — Three of four piston cooling jets spray correctly from the same oil gallery during pre-priming, confirming adequate pressure and clean galleries. [C] The single non-spraying jet, with a visually clean external nozzle, most likely has an internal manufacturing defect — a blocked internal passage, a misdrilled orifice, or casting debris inside the jet body that prevents oil from flowing through. The jet should be replaced with a new one and tested again during pre-priming to confirm flow.

20. D — Technician A only is correct: an engine block with a crack between a cylinder bore and a coolant passage is generally not cost-effectively repairable and should typically be replaced. [C] Technician B is wrong because the statement that block cracks can "always" be reliably repaired

regardless of location is false. While some block cracks in non-critical locations can be repaired by welding or cold-metal stitching, cracks between bores and coolant passages are in high-stress, high-temperature areas where repairs frequently fail under the thermal and pressure cycling of normal engine operation.

21. A — An engine that died when the vehicle went through a deep puddle and now will not crank (starter clicks but engine does not rotate) on a fully charged battery is the classic presentation of hydrostatic lock from water ingestion. [A] Water drawn through the air intake fills one or more cylinders. Because water is incompressible, the piston cannot reach TDC and the starter cannot rotate the crankshaft. The correct first step is to remove the spark plugs and crank the engine to expel the water. Forcing the engine to turn with water in the cylinders risks bending connecting rods.

22. D — The bore was bored to 0.020 oversize (3.8200) during the previous rebuild and has now worn to 3.8220 — an additional 0.0020 inches of wear. [C] This additional wear means the bore is now 0.0020 inches beyond the previous oversize dimension. Combined with the 0.002-inch taper that is at the maximum specification limit, the bore has reached a condition where it cannot be adequately restored by honing alone. Boring to 0.030-inch oversize (3.8300) removes the wear and taper, providing a fresh cylindrical surface for new 0.030-oversize pistons.

23. C — Normal cranking vacuum (2 in. Hg) indicates air is being drawn into the cylinders — the valves are opening and the intake is not sealed. [A] Yet compression is only 42 to 50 PSI on all cylinders. This apparent contradiction is resolved if the valve timing is slightly off: the valves open enough to draw air in (producing vacuum) but close too late in the compression stroke, allowing much of the charge to escape back through the still-open valve before full compression can build. This is consistent with a timing chain or belt that has jumped a few teeth.

24. B — An engine consuming one quart per 800 miles with no visible exhaust smoke despite normal compression and leak-down is a common and frequently misunderstood condition. [D] The catalytic converter operates at temperatures exceeding 1,200°F and is highly effective at oxidizing small amounts of oil hydrocarbons in the exhaust stream before they exit the tailpipe as visible smoke. The oil is being burned in the combustion chambers, but the converter eliminates the visible evidence before it reaches the driver's eye.

25. A — Polishing marks on fillet radii that are present on only some rod journals — not all — indicate that the rod bearings or connecting rods at those positions were contacting the fillet during operation. [C] This contact can occur from bearings that are slightly too wide, connecting rods with insufficient side clearance, or rods that have shifted laterally on the journal. Fillet contact creates a stress concentration at the most fatigue-sensitive location on the crankshaft. While the crankshaft passed

Magnaflux now, continued fillet contact during future operation would eventually initiate a fatigue crack.

26. D — A startup rattle from the timing chain area that has been progressively lengthening from one second to four seconds over six months points to the hydraulic tensioner's ability to maintain its oil charge overnight deteriorating. [B] The tensioner's internal check valve and plunger seals prevent oil from draining out when the engine is off. As these components wear, oil drains faster overnight, and the tensioner plunger retracts further. Each morning, the chain has more slack, and it takes the oil system longer to refill the tensioner and take up the slack — hence the progressively longer rattle.

27. B — The large pressure difference between cold startup (60 PSI) and hot idle (25 PSI) is entirely normal and explained by oil viscosity changes. [D] Cold oil is thick (high viscosity) and resists flow through bearing clearances, creating high back-pressure that the gauge reads as elevated pressure. As the oil reaches operating temperature and thins to its designed hot viscosity, it flows through the same clearances much more easily, and the measured pressure drops proportionally. The 55 PSI at 2,500 RPM hot confirms the pump and bearings are functioning correctly. All readings are within specification.

28. C — High HC emissions with no misfires, normal compression, a functional converter, and correct spark plugs suggest a marginally incomplete combustion condition that is too subtle to cause detectable misfires but still produces excess unburned hydrocarbons. [E] A slight vacuum leak creates a marginally lean condition on every combustion cycle. The mixture is lean enough to slow flame propagation and leave a small amount of fuel unburned at the edges of the combustion chamber, but not lean enough to cause a detectable misfire. The cumulative effect across all cylinders produces measurably elevated tailpipe HC.

29. A — The dark, discolored band at the exact height of the top compression ring at TDC is the carbon ridge line — the boundary between the area swept by the piston rings (below the band) and the area above ring travel where combustion gases directly contact the bore wall (above the band). [C] Combustion byproducts — carbon, soot, and heat — stain the bore surface in this narrow band where the top ring reverses direction. The area above (the ridge) retains the original machined finish because it was never swept by the rings. This is a normal wear landmark, not damage.

30. D — With a verified-functional thermostat, negative block test, correct coolant level, and a system that holds pressure, the most likely remaining cause of a rhythmically fluctuating temperature gauge is a trapped air pocket circulating through the system. [D] As the air pocket passes the ECT sensor, the sensor reads a momentary temperature spike (air does not absorb heat as effectively as liquid coolant). When liquid coolant replaces the air at the sensor, the reading normalizes. The cycle repeats as the air pocket circulates through the cooling loop. Bleeding the system resolves the fluctuation.

31. C — A cracked and partially dislodged valve seat insert must be completely removed, the bore inspected for damage, and a new insert pressed in before the seat can be cut to specification. [B] The correct sequence is critical: remove the old insert pieces, inspect the bore for cracks or enlargement from the dislodged fragment, press in a new interference-fit insert, and then cut the seat angles on the new insert. Attempting to lap, weld, or reuse a fractured insert is not a viable repair.

32. B — Reusing existing head bolts that "appear to be in good condition" is acceptable only if they are confirmed as non-TTY design AND they pass dimensional inspection. [B] The question states the condition is that they are not TTY — but simply appearing to be in good condition is not sufficient verification. The bolts should be measured for length, inspected for thread damage, and compared to the manufacturer's reuse criteria. All other listed steps — checking block deck warpage, inspecting the head for cracks, and flushing the cooling system — are mandatory during any head gasket repair.

33. D — Oil pressure that is identical at idle and at 2,500 RPM — 30 PSI at both speeds — means the pump output is being capped at 30 PSI regardless of how much oil the pump moves at higher speed. [D] The oil pressure relief valve is stuck partially open, diverting excess oil back to the pan at all times. At idle, the pump produces approximately 30 PSI. At 2,500 RPM, the pump produces much more volume, but the stuck-open relief valve dumps the excess, preventing the pressure from rising above 30 PSI. Cleaning or replacing the relief valve resolves the flat pressure curve.

34. A — Only three of the eight exhaust guides are worn beyond specification, so only those three require repair or replacement. [B] However, while the guides are being serviced, new valve stem seals should be installed on all exhaust valve positions — not just the three with worn guides — because the seals are inexpensive, the labor access is already achieved, and the remaining seals on 175,000-mile exhaust valves are likely near the end of their service life. The intake guides are within specification and do not require service.

35. C — A P0234 overboost code with actual boost reaching 22 PSI versus a 17 PSI specification means the turbocharger is generating more boost than the system is designed to limit. [A] The wastegate is the component responsible for limiting boost pressure by diverting exhaust gas away from the turbine when target boost is reached. If the wastegate is stuck closed or its actuator cannot open the gate, no exhaust is diverted, the turbine continues to accelerate, and boost exceeds the design limit. The customer's report of increased power confirms the engine is receiving more boost than specified.

36. A — Technician A only is correct: cylinder bore glaze — the smooth, polished surface left after extended operation removes the crosshatch hone pattern — must be removed by honing before new rings are installed. [C] Without the crosshatch valleys, new rings have no oil retention surface to lubricate against, no controlled abrasion surface to seat against, and will slide over the glazed surface

without conforming to the bore. Technician B is wrong because no amount of break-in cylinder pressure can force rings to seat against a glazed surface that lacks the microscopic texture needed for the seating process.

37. D — A burned exhaust valve is a cylinder head and valvetrain problem — there is no mechanism by which a burned valve damages a connecting rod bearing. [B] All other inspections are directly relevant: the valve seat must be checked for erosion from the hot gas leak that accompanied the burn, the guide must be checked for wear that may have contributed to the valve failure, and all remaining valves and seats should be inspected for developing problems while the head is disassembled. Rod bearing inspection is unrelated to a valve condition.

38. B — A rod cap bolt that has backed out three turns is a critical fastener failure that could have led to catastrophic engine damage if it had continued to loosen. [C] Simply retorquing the loose bolt is unsafe because the bolt may have been damaged by the cyclic loading with insufficient clamp force, and the bearing surfaces have been operating under abnormal conditions. The correct repair is to replace both rod bolts on that rod, install new bearing shells, verify the clearance with Plastigage, and carefully inspect the journal for any scoring or heat damage from the inadequate clamping force.

39. C — Three alternator failures in one year with a good battery, new belt and tensioner, and no parasitic draw points to an underlying condition that overworks the alternator. [E] A voltage drop in the charging circuit — from corroded cable terminals, a loose connection at the alternator output terminal, or a high-resistance splice in the charge wire — prevents the full alternator output from reaching the battery. The alternator's internal regulator senses the low voltage at the battery and commands higher output to compensate, causing the alternator to run at maximum output continuously. This chronic overwork overheats the alternator and causes premature failure.

40. A — Head bolts that are 0.25 inches shorter than specified have fewer threads engaged in the block, which directly reduces the bolt's clamping force on the head gasket. [B] With fewer threads carrying the load, the stress per thread increases, and the total clamping force available is reduced below the gasket manufacturer's minimum requirement. Under high cylinder pressures — heavy acceleration, towing, or sustained high-load operation — the insufficient clamping force may allow the gasket to lift and leak. The engine may have been asymptomatic for 2,000 miles of light driving, but the risk of gasket failure under load is significantly elevated.

41. D — A heavy misfire on two specific cylinders during cold start only, with normal compression at operating temperature and verified ignition/fuel components, points to a fuel delivery imbalance specific to those two cylinders during the cold-start enrichment period. [A] If the injectors on cylinders 1 and 4 have slightly different flow characteristics — either over-delivering or under-delivering during the

PCM's cold-start enrichment pulse — the resulting mixture imbalance produces a misfire until the engine warms and the PCM transitions to closed-loop fuel control, which compensates for the injector variation.

42. A — A visibly rounded cam lobe on a 175,000-mile engine warrants measurement before any repair recommendation is made. [B] Some cam lobes are designed with a gentler profile than others (particularly exhaust lobes), and what appears rounded to the eye may still be within specification when measured. Conversely, a lobe that appears only slightly worn may be significantly below specification. The technician should measure the lobe lift with a micrometer and compare it to the manufacturer's specification before advising the customer.

43. C — The oil consumption rate of one quart per 1,000 miles falls exactly at the manufacturer's stated normal threshold. [D] While the customer's previous experience with a similar vehicle that consumed no measurable oil is understandable, vehicle-to-vehicle variation exists even within the same model. The technician should acknowledge the customer's concern empathetically while explaining that the manufacturer has determined this rate is within the acceptable design parameters for this engine. If the customer is dissatisfied, the manufacturer's specification provides the documented standard.

44. B — A compression gauge needle that bounces erratically rather than climbing smoothly in even increments on one cylinder — while all other cylinders show smooth, incremental builds — indicates the sealing on that cylinder is inconsistent from stroke to stroke. [A] A sticky valve that intermittently hangs open during some compression strokes and seats properly during others would produce this exact pattern — some strokes build full compression while others leak, causing the needle to jump unevenly. A consistently burned valve or consistently worn rings would produce a steady (though low) build pattern, not erratic behavior.

45. A — A raised burr on the inner edge of a freeze plug bore prevents the new plug from seating flat and flush against the bore surface, creating a gap where coolant can leak past the plug under system pressure. [C] The burr must be removed with a file, die grinder, or scraper to restore a smooth, flat sealing surface before the new plug is installed. Relying on installation force to flatten the burr is unreliable and may deform the plug unevenly, compromising the seal.

46. B — A fuel system that reads 0 PSI at key-on after two weeks of sitting, but builds to the correct 55 PSI after three seconds of pump operation, confirms the fuel rail has lost all pressure during the sitting period. [E] A properly sealing fuel system retains near-specification pressure for days or even weeks after key-off. Total pressure loss indicates a leaking component — the fuel pump check valve, a fuel injector, or the pressure regulator — has allowed all fuel to drain back to the tank. The extended crank time equals the time needed to completely repressurize the empty rail and lines.

47. C — A camshaft with 0.050 inches more lift than stock pushes the valves further into the combustion chamber. [B] The valve springs must have enough travel to accommodate the additional lift without reaching coil bind (where the coils contact each other and the spring becomes solid), which would catastrophically damage the valvetrain. The springs must also have sufficient pressure at the new maximum lift to control the valve against the increased acceleration forces of the more aggressive lobe profile. Spring pressure and travel verification are the most critical checks before installing a higher-lift camshaft.

48. D — Oil pressure readings of 70 PSI at idle and 85 PSI at speed — far above the 25–35 and 45–65 PSI specifications — indicate the system pressure is not being regulated. [D] The oil pressure relief valve is stuck in the closed position and is not opening to divert excess oil back to the pan. Without the relief valve functioning, the positive-displacement pump continues to push more oil into the system as RPM increases, and pressure rises uncontrolled. This overpressure can blow out gaskets, burst oil filter housings, and damage seals.

49. A — Engine oil that has been contaminated with coolant for an extended period and has turned into a thick, gray-green mayonnaise-like sludge has lost all lubricating properties. [D] Ethylene glycol from the coolant is chemically corrosive to bearing surfaces — it attacks the copper, lead, and aluminum in bearing alloys, causing rapid surface deterioration. An engine that has been running with this level of coolant contamination for an extended period has almost certainly sustained bearing damage throughout. The bearings are the most critical concern because their failure leads to the most expensive and catastrophic consequences.

50. B — A thorough road test under varied real-world conditions is the single most comprehensive verification of a successful engine rebuild because it exercises every engine system under the actual operating conditions the vehicle will experience in daily use. [A] Cold start tests the enrichment and lifter fill-up. Warm-up tests the thermostat and cooling system progression. Idle tests base compression and oil pressure. Cruise tests sustained operation. Acceleration tests maximum cylinder pressure and turbo/supercharger function if applicable. Deceleration tests valve sealing under high vacuum. Hill climbing tests maximum sustained load. No single bench test replicates this full spectrum of operating conditions.