

# PRACTICE EXAM 13: ASE A1 ENGINE REPAIR SIMULATION (50 QUESTIONS)

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1. A technician is diagnosing an inline-6 engine with a misfire that is present only at idle and disappears completely above 1,200 RPM. A compression test shows all six cylinders between 148 and 158 PSI — all within the 140 to 165 PSI specification. A leak-down test shows all cylinders between 5% and 9% — all within acceptable limits. Ignition and fuel components have been swapped and the misfire stays on cylinder 3. A smoke test reveals a thin wisp of smoke seeping from the area where the intake manifold runner for cylinder 3 meets the cylinder head. Which of the following is the MOST likely cause?

- A. A vacuum leak at the cylinder 3 intake runner gasket surface that only affects idle because the proportional effect of the leak is greatest at low airflow volumes
- B. A cracked intake valve on cylinder 3 that seals under higher pressures at speed but leaks at idle
- C. A worn exhaust cam lobe on cylinder 3 that reduces exhaust scavenging only at low-RPM conditions
- D. An intermittent ignition coil failure on cylinder 3 that the swap test failed to reproduce correctly

2. A customer reports that the engine produces a metallic rattling noise from the top of the engine during the first 3 seconds of every cold start. The noise disappears completely and does not return at any temperature or load condition. The engine has a DOHC design with a single timing chain driving both camshafts. Oil changes are performed every 5,000 miles with the correct full synthetic specification. The engine has 85,000 miles. Which of the following components is MOST likely causing the brief startup rattle?

- A. The timing chain tensioner that has lost spring preload and cannot take up chain slack when cold
- B. The exhaust camshaft lobes that produce a momentary tick until oil coats the follower contact surface
- C. The hydraulic chain tensioner that drains oil overnight and takes a few seconds to refill at startup
- D. The serpentine belt tensioner that bounces until the accessory drive reaches stable operating speed

3. A V8 engine has a persistent P0305 misfire code on cylinder 5. The technician has replaced the spark plug, ignition coil, and fuel injector on cylinder 5 — the code persists. A compression test shows cylinder 5 at 135 PSI while all other cylinders are between 152 and 162 PSI. The specification minimum

is 140 PSI. A wet test on cylinder 5 raises the reading to 138 PSI. A leak-down test shows 18% leakage with air audible at the exhaust tailpipe. Which of the following is the MOST likely cause of the misfire?

- A. Worn piston rings on cylinder 5 that the wet test confirms as the primary compression leak source
- B. An exhaust valve on cylinder 5 that is not sealing properly and is leaking compression to the exhaust
- C. A head gasket breach between cylinder 5 and an adjacent coolant passage causing dilution
- D. Carbon buildup on the piston crown of cylinder 5 that has raised local compression beyond specification

4. An engine block is being inspected during a rebuild. The technician discovers that all six cylinder bores have a ring ridge at the top of the ring travel area. The ridges range from 0.003 to 0.005 inches in height. The technician plans to pull the pistons out of the bores for inspection. Which of the following is the correct procedure BEFORE removing the pistons?

- A. Lubricate the ridges with assembly oil so the rings can slide over them without catching during removal
- B. Push each piston to BDC and rotate the crankshaft to force the rings past the ridge from below
- C. Pull each piston upward through the ridge using steady force to pop the rings past the obstruction
- D. Remove the ring ridges with a ridge reamer before pulling the pistons to prevent ring land damage

5. A technician is performing an oil pressure test on a rebuilt engine at the 500-mile break-in service. The readings are: cold idle = 65 PSI, hot idle = 32 PSI, hot at 2,500 RPM = 58 PSI. The specification is 20 PSI minimum at hot idle and 40 to 65 PSI at speed. Which of the following is the correct interpretation of these readings?

- A. All readings are within specification and the pressure difference between cold and hot is normal viscosity behavior
- B. The hot idle reading of 32 PSI indicates the bearings were assembled with excessive clearance
- C. The cold reading of 65 PSI indicates the relief valve is stuck closed and not regulating maximum pressure
- D. The hot speed reading of 58 PSI should be closer to 65 PSI and indicates the pump is wearing prematurely

6. A customer's vehicle has a turbocharged four-cylinder engine that is producing excessive blue exhaust smoke during sustained boost conditions. There is no smoke at idle or during light throttle driving. The turbocharger was replaced six months ago. Oil consumption is approximately one quart every 500 miles. A compression test shows all cylinders within specification. Which of the following should the technician inspect FIRST?

- A. The valve stem seals for heat degradation from the turbocharger's proximity to the exhaust ports
- B. The piston ring end gaps to determine if they were set too wide during a previous engine service
- C. The turbocharger oil drain line for restriction that could cause oil to back up past the turbo seals
- D. The cylinder bore finish to determine if the crosshatch pattern has deteriorated under boost pressures

7. Technician A says that when a head gasket fails between two adjacent combustion chambers, the compression test will show low readings on both affected cylinders. Technician B says that when a head gasket fails between a combustion chamber and a coolant passage, the leak-down test will show bubbles in the coolant. Who is correct?

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

8. A freshly rebuilt engine has been running for 100 miles. During a quality check, the technician discovers that the engine is consuming approximately one quart of oil every 50 miles. There is heavy blue smoke from the exhaust at all operating conditions. Compression is within specification and actually slightly higher than the pre-rebuild readings on all cylinders. Oil pressure is within specification. Which of the following assembly errors is MOST likely responsible?

- A. The piston ring end gaps were set too wide, allowing oil and compression to pass through the gaps
- B. The valve stem seals were not replaced during the head gasket service that accompanied the rebuild
- C. The cylinder bores were honed with too rough a crosshatch finish that is trapping excessive oil
- D. The piston rings were installed with the wrong side facing up, pumping oil into the combustion chambers

9. A vehicle owner reports that the engine makes a single loud clicking sound from the engine compartment every time the air conditioning compressor clutch engages. The sound occurs at initial engagement and does not repeat while the compressor is running. All other engine sounds are normal. Which of the following is the MOST likely cause?

- A. A worn A/C compressor clutch bearing that clicks when the magnetic field first activates
- B. Normal operation — the A/C compressor clutch produces an audible click when the electromagnetic coil engages
- C. A cracked compressor mounting bracket that shifts when the compressor torque is first applied
- D. Excessive crankshaft end play that allows the crank to shift when the compressor load is applied

10. A technician is diagnosing an engine that runs smoothly at all speeds except during a very specific condition: when the engine is decelerating from 3,000 RPM to idle with the throttle fully closed, the engine stumbles and nearly stalls for approximately one second before recovering to a stable idle. The condition is repeatable. Compression and all mechanical tests are normal. Which of the following is the MOST likely cause?

- A. An idle air control valve or electronic throttle that responds too slowly during the rapid transition from cruise to idle
- B. Low compression on one cylinder that cannot sustain combustion during the low-pressure deceleration event
- C. A burned exhaust valve that only leaks under the extremely high vacuum of the deceleration condition
- D. A timing chain that momentarily slackens during the rapid RPM change and causes a brief timing error

11. A technician is measuring the valve spring installed height on a cylinder head after reconditioning. The specification is 1.650 to 1.700 inches. The measured height on the number 4 exhaust valve is 1.730 inches. A 0.030-inch shim is available. After installing the shim, the corrected height would be 1.700 inches. Which of the following describes the resulting spring condition?

- A. The corrected height of 1.700 inches is too tight at the absolute maximum of specification
- B. The corrected height of 1.700 inches is within specification and the spring will provide adequate closing force

- C. The shim installation will over-compress the spring and lead to premature spring fatigue failure
- D. A 0.060-inch shim should be used instead to place the height at the middle of the specification range

12. A technician discovers that a vehicle has been running with the incorrect oil filter for approximately 15,000 miles. The installed filter has a lower bypass valve pressure rating than specified. The engine has developed a slight valvetrain ticking that was not present before. Which of the following BEST explains how the incorrect filter contributed to the noise?

- A. The lower bypass pressure allowed the filter to bypass prematurely, sending unfiltered oil to the valvetrain
- B. The incorrect filter restricted oil flow, causing starvation to the hydraulic lifters and producing the tick
- C. The wrong filter had an oversized center tube that reduced oil volume delivered to the main gallery
- D. The lower bypass pressure caused the filter to collapse internally and block oil flow to the upper engine

13. A customer reports that the engine temperature gauge reads higher than normal — approximately three-quarters instead of the usual halfway mark — but only when driving in city traffic on hot days. The gauge returns to the halfway mark on the highway. The coolant level is correct, the radiator cap holds its rated pressure, and a block test is negative. The cooling fan engages when the temperature rises but seems to run continuously during the episode. Which of the following is the MOST likely cause?

- A. A faulty ECT sensor that reads higher than actual temperature only when the engine is under thermal stress
- B. The cooling fan is operating on low speed only and not switching to high speed when the temperature demands it
- C. A partially restricted radiator that cannot dissipate enough heat under the low-airflow conditions of city traffic on hot days
- D. A thermostat that opens too late, allowing the temperature to overshoot before coolant reaches the radiator

14. A technician is rebuilding a high-mileage OHV engine. During camshaft inspection, one exhaust lobe measures 0.008 inches less lift than the specification. All other lobes are within 0.001 inches of specification. The lifter that rode on the worn lobe shows a slightly concave contact face. Which of the following is the correct repair approach?

- A. Replace the camshaft and all lifters as a set because the worn lobe and its matching lifter must not be separated
- B. Replace only the worn lifter with a new one and reuse the camshaft because one lobe is not critical
- C. Regrind the worn lobe to a smaller but uniform profile and adjust the valve lash to compensate
- D. Replace only the camshaft and reuse the existing lifters since they still have serviceable dimensions

15. A rebuilt engine produces normal oil pressure at idle and at speed. However, after the engine is shut off and sits for four hours, the technician restarts it and notices a brief two-second period of zero oil pressure on the gauge before it jumps to 50 PSI. During those two seconds, a faint lifter tick is audible. Which of the following is the MOST likely cause of the delayed oil pressure on restart?

- A. The oil pump has a worn drive gear that slips for two seconds before engaging on each restart
- B. The oil filter anti-drain-back valve is not functioning properly, allowing the filter to drain while sitting
- C. The oil pump pickup tube O-ring has a slow leak that allows air into the pump during sitting periods
- D. The main oil gallery has a small crack that allows oil to seep out of the pressurized system over time

16. A customer reports that the engine hesitates and sometimes backfires through the intake during acceleration from a stop. The engine idles smoothly. A compression test shows all four cylinders within specification. A vacuum gauge reads a steady 19 in. Hg at idle. When the throttle is opened quickly, the vacuum drops to near zero as expected, but the engine stumbles badly before recovering. Fuel pressure is within specification at all times. Which of the following is the MOST likely cause?

- A. Low compression that only manifests under the higher cylinder pressures of acceleration loading
- B. A partially restricted catalytic converter that creates back-pressure only during acceleration events
- C. Worn valve guides that allow oil past the guides during the rapid vacuum change of throttle opening
- D. A misfire from an ignition or fuel delivery problem that occurs during the rapid transient throttle event

17. A technician is measuring crankshaft main journal number 2. Four measurements are taken: front of journal perpendicular to crank = 2.4989, front parallel = 2.4986, rear perpendicular = 2.4985, rear parallel = 2.4983. The standard specification is 2.4990 to 2.5000. Maximum taper is 0.0005 inches. Maximum out-of-round is 0.0005 inches. Which of the following is the correct assessment?

- A. The journal is within standard specification because all measurements are within 0.001 of the minimum
- B. The journal taper is 0.0004 inches and out-of-round is 0.0003 inches — both within specification but the journal is below standard minimum diameter
- C. The journal must be reground because the maximum diameter is below the standard minimum specification
- D. The journal is acceptable for reuse with standard bearings because the taper and out-of-round are within limits

18. A vehicle with an inline-4 engine has been diagnosed with a blown head gasket between cylinder 2 and a coolant passage. During the repair, the technician removes the cylinder head and inspects the block deck surface. A precision straightedge and feeler gauge reveal 0.002 inches of warpage on the block deck. The maximum specification is 0.004 inches. Which of the following is the correct action for the block deck?

- A. The block deck is within specification and can be used as-is after thorough cleaning without resurfacing
- B. The block deck should be resurfaced to remove the warpage even though it is within specification
- C. The block deck must be resurfaced because any measurable warpage on the block requires correction
- D. The block deck is borderline and should be resurfaced as a precaution to ensure proper gasket sealing

19. A technician is diagnosing a six-cylinder engine that produces a rhythmic vacuum gauge fluctuation at idle — the needle swings between 15 and 19 in. Hg in a repeating pattern. The fluctuation rate corresponds to the firing frequency of a single cylinder. Disabling the fuel injector on cylinder 4 eliminates the fluctuation and the vacuum steadies at 18 in. Hg. Which of the following BEST explains these findings?

- A. Cylinder 4 has worn piston rings that are allowing blowby during every compression stroke at idle
- B. Cylinder 4 has a valve that is not sealing properly, causing a compression leak during each of its cycles
- C. Cylinder 4 has a clogged fuel injector that is not delivering fuel and causing that cylinder to misfire
- D. Cylinder 4 has a vacuum leak at its intake runner that is introducing unmetered air during each intake stroke

20. A technician is performing an oil analysis on a sample from a vehicle with 8,000 miles since the last oil change. The analysis shows elevated sodium and potassium levels — elements that are commonly found in coolant additive packages but not in engine oil. The engine has no visible leaks, no overheating, no white smoke, and no milky oil on the dipstick. Which of the following is the correct interpretation?

- A. The elevated sodium and potassium are from the oil additive package and are not indicative of coolant
- B. The oil analysis lab has made an error because all other coolant contamination indicators are absent
- C. The engine has excessive blowby that is introducing atmospheric moisture containing these minerals
- D. A very small internal coolant leak is introducing coolant into the oil in quantities too small to produce visible symptoms

21. A rebuilt engine develops a ticking noise from the number 3 exhaust position on an OHV engine. The noise appeared at approximately 1,000 miles after the rebuild. The technician removes the valve cover and discovers that the pushrod for the number 3 exhaust has a slight lateral bow visible when rolling it on a flat surface. All other pushrods roll true. Which of the following is the MOST likely cause of the bent pushrod?

- A. The pushrod was reused from the original engine and had a pre-existing bend that was not detected
- B. The new camshaft's exhaust lobe profile is slightly more aggressive than the original, overstressing the pushrod
- C. The rocker arm geometry is incorrect because the wrong rocker arm was installed at the number 3 position
- D. The hydraulic lifter at number 3 exhaust intermittently over-extends due to an internal defect, creating excessive valve opening force that bent the pushrod

22. Technician A says that the purpose of the oil filter bypass valve is to allow oil to flow to the engine when the filter becomes clogged, ensuring lubrication is never interrupted. Technician B says that when the bypass valve opens, unfiltered oil circulates through the engine, which can cause accelerated wear. 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

23. A vehicle with an automatic transmission exhibits a single loud clunk from the rear of the engine every time the transmission shifts from Park to Drive. The clunk does not repeat during driving. No clunk occurs when shifting from Park to Reverse. The engine mounts are intact. Which of the following is the MOST likely cause?

A. A worn transmission mount that allows the drivetrain to shift forward when Drive is engaged

B. A loose torque converter bolt that shifts when the converter applies forward torque to the crank

C. Excessive crankshaft end play that allows the crankshaft to shift forward when the converter loads in Drive

D. A broken motor mount bracket that allows the engine to rock forward when forward gear is selected

24. A technician is testing the charging system on a vehicle after an engine repair. With the engine running at 2,000 RPM and all accessories off, the voltmeter reads 14.2 volts across the battery terminals. The technician then turns on the headlights, blower motor on high, and rear defogger. The voltmeter drops to 13.8 volts but remains steady. The specification is 13.5 to 14.8 volts. Which of the following is the correct interpretation?

A. The alternator is failing because it cannot maintain 14.2 volts under load and has dropped 0.4 volts

B. The charging system is functioning correctly — the voltage drop under load is normal and the reading remains within specification

C. The battery is weak and pulling voltage down during the high-demand test despite adequate alternator output

D. The voltage regulator is cycling and not maintaining steady output under the electrical load conditions

25. A technician is diagnosing an engine that overheats intermittently. The overheating has no consistent pattern — it occurs sometimes in traffic, sometimes at highway speed, sometimes after 10 minutes of driving, and sometimes after 30 minutes. All cooling system components have been tested and are functional. The system holds pressure, the block test is negative, and the coolant level remains stable. Which of the following is the MOST difficult-to-diagnose cause that could produce this random pattern?

- A. A radiator cap with an intermittently sticking pressure relief valve that randomly vents pressure
- B. A cooling fan relay with an intermittent electrical connection that randomly loses contact and drops the fan
- C. A water pump impeller that has partially separated and intermittently slips on the shaft under varying loads
- D. An intermittent electrical fault in the coolant temperature sensor circuit that randomly triggers false high readings or delays fan activation

26. A four-cylinder engine has the following compression results: Cyl 1 = 155, Cyl 2 = 150, Cyl 3 = 95, Cyl 4 = 152 PSI. A wet test on cylinder 3 raises the reading to 140 PSI. A leak-down test on cylinder 3 shows 22% leakage with air heard ONLY at the oil filler cap — no air at the tailpipe, intake, or coolant. Which of the following is the MOST accurate diagnosis?

- A. Cylinder 3 has worn piston rings confirmed by both the wet test improvement and the leak-down air path to the crankcase
- B. Cylinder 3 has a burned intake valve because the low compression would not improve on a wet test if valves were the issue
- C. Cylinder 3 has a head gasket failure that is leaking compression into an oil return passage in the gasket
- D. Cylinder 3 has a cracked piston that allows compression past the ring pack into the crankcase area

27. A customer reports that the engine oil pressure gauge reading has been gradually declining over the past year. Current readings are: hot idle = 18 PSI, hot 2,500 RPM = 40 PSI. The specification is 15 PSI minimum at idle and 40 to 65 PSI at speed. The engine has 165,000 miles. No knocking is present. Which of the following is the MOST appropriate recommendation?

- A. Replace the oil pump immediately because the speed pressure of 40 PSI is at the minimum specification
- B. Monitor the pressure at each oil change and advise the customer that the readings are still within specification but trending downward
- C. Switch to a heavier viscosity oil to increase both idle and speed pressure readings above current levels
- D. Rebuild the engine because the declining pressure trend will inevitably lead to bearing failure soon

28. A technician is inspecting a set of flat-tappet lifters removed from a high-mileage OHV engine. Most lifters show a slightly convex face (the correct factory profile). However, two lifters have faces that are perfectly flat with no convexity remaining. The camshaft lobes that these lifters rode on appear normal to visual inspection. Which of the following is the correct interpretation?

- A. The flat-faced lifters are within normal specification because the convex profile wears to flat over time
- B. All lifters should be replaced as a matched set regardless of individual face condition during a rebuild
- C. The flat-faced lifters can be polished to restore the convex profile and reinstalled on the same cam lobe
- D. The two flat-faced lifters have lost their designed convexity and must be replaced because they will no longer rotate on the cam lobe

29. A technician replaces a crankshaft rear main seal on a vehicle and road tests it for 20 miles. Upon return, a small amount of oil is visible at the rear of the engine. The technician cleans the area and runs the engine at idle for 30 minutes — no new oil appears. The technician drives the vehicle aggressively for another 20 miles and the oil reappears at the rear. Which of the following is the MOST likely explanation?

- A. The seal leaks only under driving conditions because crankcase pressure increases under load from normal blowby volume changes
- B. The oil is residual from the repair that was trapped in a cavity and is slowly draining from vibration
- C. The new seal was installed at an incorrect depth and only contacts the crankshaft properly at idle RPM
- D. The rear main seal housing bolts were not torqued to specification and the housing shifts under load

30. A six-cylinder engine has compression readings that are all within specification and within 10% of each other. However, the engine exhibits a persistent rough idle with long-term fuel trim at plus 22% on bank 1 and plus 4% on bank 2. A smoke test reveals no vacuum leaks. The intake manifold gaskets were replaced recently. Which of the following is the MOST likely cause of the bank 1 lean condition?

- A. A failing fuel pump that cannot deliver adequate fuel to the bank 1 injectors under idle demand
- B. A partially clogged catalytic converter on bank 1 that is reducing exhaust flow and causing a lean reading

C. The replacement intake manifold gasket on bank 1 is not sealing properly despite a negative smoke test

D. The bank 1 oxygen sensor is reading falsely lean due to contamination, causing the PCM to over-enrich

31. A technician discovers during an engine teardown that the main bearing caps are numbered 1 through 5 from front to rear. However, cap number 3 has an additional letter "T" stamped next to the number. Which of the following does this marking indicate?

A. The "T" indicates this cap has been previously torqued to yield and should not be reused during assembly

B. The "T" indicates this cap was manufactured from a different alloy than the others for added strength

C. The "T" identifies this cap as the thrust bearing cap that controls crankshaft end play in the engine

D. The "T" indicates the cap requires thread sealant on its bolts because they pass through a coolant jacket

32. A vehicle with a DOHC engine is brought in after the customer heard a loud snap from the engine followed by immediate rough running. The engine will run but shakes violently and has no power. A compression test shows: Cyl 1 = 155, Cyl 2 = 40, Cyl 3 = 150, Cyl 4 = 152. A borescope inspection through the cylinder 2 spark plug hole reveals a broken valve spring retainer sitting on top of the piston crown. Which of the following has MOST likely occurred?

A. The valve spring retainer cracked from fatigue and the valve has dropped partially into the cylinder

B. The valve lock (keeper) failed, releasing the retainer and allowing the valve to drop into the combustion chamber

C. The valve spring broke and the retainer was ejected by the remaining spring tension into the chamber

D. The rocker arm pivot broke and the retainer was knocked off by the flailing rocker arm during operation

33. A technician performs an exhaust back-pressure test on a vehicle with a gradual power loss complaint. At idle, the gauge reads 0.8 PSI. At 2,500 RPM, the gauge reads 2.5 PSI. The specifications are less than 1.5 PSI at idle and less than 3.0 PSI at speed. Both readings are within specification. However, when the technician holds 2,500 RPM for 60 seconds, the pressure climbs from 2.5 to 3.8 PSI. Which of the following does this progressive pressure rise indicate?

- A. A catalytic converter that is partially restricted and gradually traps exhaust gas under sustained flow
- B. Normal exhaust system behavior because back-pressure always rises with sustained elevated RPM
- C. A muffler with failing internal baffles that vibrate and progressively block flow at constant speed
- D. An exhaust manifold gasket leak that worsens as the manifold heats and expands during sustained RPM

34. A customer brings in a vehicle stating that the engine runs perfectly except for a brief hesitation when the accelerator pedal is first pressed from the idle position. The hesitation lasts less than one second and then the engine accelerates normally. No codes are stored. Compression, fuel pressure, and ignition are all normal. A vacuum gauge shows a steady 19 in. Hg at idle that drops normally during acceleration. Which of the following is the MOST likely cause?

- A. A worn throttle position sensor that sends a momentary incorrect signal during the first degree of opening
- B. A carbon-coated throttle body bore that temporarily restricts airflow until the throttle plate passes the deposit
- C. Low compression on one cylinder that becomes apparent only during the initial pressure rise of acceleration
- D. A dirty or sluggish accelerator pump or tip-in fuel enrichment calibration that delays fuel delivery during the initial throttle opening

35. A technician is assembling a rebuilt engine and discovers that the connecting rod on cylinder 2 has the cap installed correctly but the rod itself appears to be reversed — the oil squirt hole in the rod is facing away from the crankshaft rather than toward it. Which of the following consequences could result from this orientation error?

- A. The rod bearing will receive excessive oil pressure and the journal will hydroplane on the oil film
- B. The oil squirt hole will not direct oil onto the cylinder wall and piston underside, reducing lubrication to those components
- C. The connecting rod will contact the camshaft counterweight during rotation because of the reversed offset
- D. The piston wrist pin will bind in the connecting rod small end because the rod is reversed on the pin

36. A customer reports that the engine occasionally hesitates during light-throttle cruising at approximately 40 mph. The hesitation is brief and unpredictable — sometimes it happens three times during a 20-minute drive and sometimes not at all. No codes are stored. All engine mechanical tests are normal. The technician monitors scan tool data during a test drive and observes that during each hesitation event, the EVAP purge duty cycle spikes to 100% momentarily. Which of the following is the MOST likely cause?

- A. The fuel injectors are momentarily losing fuel pressure when the purge valve opens and diverts fuel vapor
- B. A stuck-open EVAP canister vent valve that floods the intake with fuel vapor during the purge event
- C. The EVAP canister is saturated with fuel and releases a momentary surge of rich vapor that disrupts the idle mixture during purge
- D. The PCM's purge schedule is activating at an inappropriate time and the large vapor bolus momentarily enriches the cruise mixture

37. A technician is performing a final inspection on a rebuilt engine before delivering the vehicle. The engine has been through three heat cycles with no leaks. A compression test shows all cylinders within 5% of each other and within specification. Oil pressure is within specification. A block test is negative. The technician notices that the exhaust has a very faint blue tint visible only against a white background in direct sunlight. Oil level has not changed measurably in 100 miles. Which of the following is the MOST appropriate action?

- A. Document the observation, inform the customer that very faint oil vapor during the break-in period is common, and schedule a recheck at 500 miles
- B. Tear down the engine immediately because any visible blue tint indicates a ring seating failure
- C. Replace all valve stem seals because the blue tint confirms oil is leaking past the valve guides
- D. Rehone the cylinders because the blue tint proves the crosshatch finish is incorrect for the ring type

38. A technician is diagnosing a vehicle where the engine oil turns black within 200 miles of an oil change. The customer uses the manufacturer-specified oil and filter. The engine has 120,000 miles. No misfires, no codes, and no performance complaints are present. Oil analysis shows normal wear metal levels and no contaminants. Which of the following is the correct explanation for the rapid oil darkening?

- A. The oil filter is allowing unfiltered oil to bypass and the carbon-contaminated oil darkens the new oil
- B. The engine has excessive blowby from worn rings that forces combustion byproducts into the crankcase oil
- C. Rapid oil darkening is normal because oil is designed to absorb and suspend combustion byproducts
- D. The PCV system is malfunctioning and routing excessive crankcase gases through the oil before venting

39. An engine is being diagnosed with a noise complaint that the customer describes as a "fluttering" sound from the engine during deceleration. The noise is rhythmic, moderate in volume, and occurs only during closed-throttle deceleration from speeds above 2,000 RPM. It stops completely at idle and during acceleration. Compression and all mechanical tests are normal. Which of the following is the MOST likely source?

- A. A sticking EGR valve that opens during deceleration when it should remain closed at that condition
- B. A worn timing chain that develops slack during the low-tension conditions of deceleration throttle-off
- C. An exhaust manifold heat shield that vibrates at a specific frequency during the deceleration RPM range
- D. An exhaust valve that is not fully closing during deceleration due to a weak valve spring or carbon deposit

40. A technician is evaluating an engine for purchase at auction. The engine has unknown history. A quick compression test shows all six cylinders between 140 and 148 PSI. A vacuum gauge reads 17 in. Hg at idle. Oil pressure is 22 PSI at hot idle. There are no unusual noises. The oil appears clean. Based solely on these quick diagnostic findings, which of the following assessments is MOST accurate?

- A. The engine is in excellent condition and requires no further evaluation before purchase
- B. The basic diagnostic indicators suggest a serviceable engine, but a more thorough inspection is needed before final assessment
- C. The oil pressure of 22 PSI at hot idle indicates bearing wear that makes this engine a poor purchase
- D. The compression readings are borderline and indicate the engine will need rebuilding within 20,000 miles

41. A technician is performing a valve job on a DOHC cylinder head. After cutting all exhaust valve seats, the technician laps each valve and checks the contact pattern. All exhaust valves show a complete, even contact ring except the number 2 exhaust, which shows contact on approximately 270 degrees of the seat circumference — a 90-degree section has no contact. Which of the following is the MOST likely cause?

- A. The number 2 exhaust valve guide is worn and allowing the valve to sit eccentrically on the seat
- B. The seat cutter pilot was not properly centered in the guide during the cutting operation on seat 2
- C. The valve face on the number 2 exhaust has a localized flat spot from a previous impact event
- D. The cylinder head casting has a defect near the number 2 exhaust port that distorted the seat area

42. A customer reports that the engine runs perfectly at all speeds except during a specific condition: when the engine is fully warmed up, idling in Drive with the A/C compressor running, and the brake pedal is pressed firmly, the engine RPM drops to approximately 400 and nearly stalls. Releasing the brake or turning off the A/C prevents the condition. Compression is normal. Which of the following is the MOST likely cause?

- A. A brake booster vacuum leak that creates excessive vacuum demand when the brake is applied with the A/C on
- B. Low compression on one cylinder that becomes critical only under the triple load of idle, A/C, and brake booster
- C. An idle air control system that cannot compensate for the combined vacuum demand of the brake booster and A/C compressor load
- D. The combined load of the A/C compressor parasitic drag and the brake booster vacuum demand exceeds the engine's idle reserve capacity

43. A technician replaces the head gasket on a V6 engine. After reassembly, the engine runs but misfires on cylinder 4 with a P0304 code. The cylinder 4 spark plug is fouled with coolant residue. A compression test shows cylinder 4 at 60 PSI while all others are above 145 PSI. A block test is positive. Which of the following is the MOST likely cause?

- A. The original head gasket failure has caused permanent valve damage on cylinder 4 that was not detected

- B. The replacement head gasket was installed incorrectly or is defective and is leaking at the cylinder 4 location
- C. The cylinder head warpage was not fully corrected during resurfacing and the gasket cannot seal at cylinder 4
- D. The head bolt torque sequence was not followed correctly, resulting in uneven clamping at cylinder 4

44. An engine that has been running with a significant oil leak for several months is brought in for service. The oil level is three quarts low. The technician adds oil to the correct level and starts the engine. A loud hydraulic lifter tick is present on multiple cylinders. After 60 seconds of running, the tick stops on all but one cylinder. After five minutes, the last remaining tick also stops. Which of the following BEST explains the progressive noise resolution?

- A. The lifters were all air-locked from the low oil condition and each took varying time to pump up
- B. The oil galleries were partially drained from the low level and required time to refill before all lifters received oil
- C. Each lifter had a different degree of internal contamination that required varying amounts of oil flow to flush
- D. The lifters closest to the oil pump received oil first, and the furthest lifters took the longest to receive pressure

45. Technician A says that an engine with 50% leakage on a leak-down test and air heard only at the oil filler cap has a ring sealing problem. Technician B says that the same engine should also have low compression that improves significantly on a wet test to confirm the ring diagnosis. 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

46. A technician is rebuilding an engine and must decide whether to bore the cylinders. Five of the six cylinders show taper of 0.001 inches and out-of-round of 0.0005 inches — well within the 0.003-inch and 0.0015-inch specifications respectively. However, cylinder 4 shows taper of 0.004 inches and out-

of-round of 0.002 inches — both exceeding specification. Which of the following is the correct approach?

- A. Bore all six cylinders to the same oversize to maintain uniform displacement across the engine
- B. Hone all six cylinders and install standard rings because the average wear is within specification
- C. Bore only cylinder 4 to the next oversize and hone the remaining five for standard-size rings
- D. Bore only cylinder 4 and the two cylinders adjacent to it as a precaution against progressive wear

47. A vehicle owner reports that the engine makes a groaning or moaning sound at hot idle that disappears when the engine is revved above 1,000 RPM. The sound is low-frequency and resonant. It is not present at cold idle. Oil pressure, compression, and all mechanical tests are normal. The serpentine belt, tensioner, and all accessory pulleys have been replaced. Which of the following is the MOST likely remaining cause?

- A. An exhaust system resonance at the specific idle RPM that produces a moaning sound through the tailpipe
- B. A torsional vibration in the crankshaft at hot idle RPM that is no longer being adequately dampened by the harmonic balancer
- C. A transmission torque converter that produces a low-frequency drone when the engine is at hot idle in gear
- D. Engine mounts that have softened from heat and age, allowing the engine to vibrate against the subframe

48. A technician is performing a cooling system flush on an engine with 150,000 miles. After draining the old coolant, the technician observes that the inside of the radiator fill neck has a brown, slimy coating. The drained coolant is murky brown rather than the expected orange color of the specified Dex-Cool type. The customer's records show consistent coolant service at the correct intervals. Which of the following is the MOST likely cause of the discolored coolant?

- A. A head gasket breach that has been slowly introducing oil into the cooling system over many miles
- B. Internal corrosion caused by neglected coolant service intervals despite what the customer's records show

C. The wrong coolant type was used at some point, causing an incompatibility reaction with the Dex-Cool

D. Normal degradation of Dex-Cool coolant at 150,000 miles that produces a brown discoloration with age

49. A rebuilt engine has been running perfectly for 8,000 miles. During a routine oil change, the technician notices that the oil on the dipstick has a slight fuel odor. The oil level is at the full mark — not elevated. The engine has no misfires, no codes, and no performance issues. The customer drives primarily in city traffic with frequent short trips in cold weather. Which of the following is the MOST likely cause?

A. Fuel condensation from short-trip driving where the engine does not reach full operating temperature to evaporate fuel from the oil

B. A leaking fuel injector that drips a small amount of fuel into a cylinder during key-off overnight periods

C. A ruptured fuel pressure regulator diaphragm that allows fuel to enter the intake manifold at all times

D. Normal fuel wash past the rings during cold-start enrichment that accumulates because the engine runs cold

50. A technician is verifying crankshaft end play on a rebuilt engine. The dial indicator reads 0.014 inches of total end play. The specification is 0.002 to 0.010 inches. Which of the following is the correct action?

A. Recheck the measurement because 0.014 inches is close enough to the 0.010 maximum to be within tolerance

B. Add shims between the thrust bearing and the crankshaft cheek to reduce end play to within specification

C. Verify that the main bearing caps are all correctly positioned and torqued, as a cap in the wrong position can affect thrust

D. Replace the thrust bearing with a new or oversize unit designed to reduce end play to within the specification

## Practice Exam 13: 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. A — The smoke test confirming a vacuum leak at the cylinder 3 intake runner gasket surface directly explains the idle-only misfire. [A] At idle, airflow through the intake is minimal, so even a small unmetered air leak represents a large percentage of the total charge entering that cylinder — enough to lean the mixture beyond the misfire threshold. Above 1,200 RPM, the increased airflow volume overwhelms the fixed-size leak, and the proportional effect becomes insignificant. The normal compression and leak-down readings confirm no internal mechanical failure.

2. C — A brief metallic rattle at cold startup on a DOHC engine with a hydraulic timing chain tensioner that disappears within 3 seconds is the classic presentation of tensioner oil drain-down. [A] When the engine sits overnight, oil slowly leaks past the tensioner's internal seals and check valve, allowing the plunger to retract and the chain to develop slack. On startup, the chain rattles against the guides until oil pressure refills the tensioner (typically within 2 to 4 seconds). This is a common and well-documented characteristic of hydraulic chain tensioner systems.

3. B — Cylinder 5 at 135 PSI is below the 140 PSI minimum specification, the wet test shows minimal improvement (135 to 138 — only 3 PSI), and the leak-down shows 18% leakage with air at the tailpipe. [A] The minimal wet test improvement eliminates rings as the primary cause — oil cannot seal a valve leak. The air at the tailpipe confirms the leak path is through the exhaust valve, past the seat, and into the exhaust system. The exhaust valve is burned, bent, or has carbon deposits preventing full closure.

4. D — The ring ridge is an unworn lip at the top of the bore above the highest point of ring travel. [C] If the pistons are pulled upward through this ridge, the compression ring lands catch on the lip and can crack or break the ring lands off the piston. A ridge reamer cuts away the unworn lip, creating a smooth transition that allows the piston and rings to pass through without interference. Ridge removal is mandatory before piston extraction on any bore that has developed a measurable ridge.

5. A — All three readings fall within the manufacturer's specifications: cold idle of 65 PSI is normal for thick cold oil, hot idle of 32 PSI exceeds the 20 PSI minimum, and hot speed of 58 PSI falls within the 40 to 65 range. [D] The significant difference between cold and hot idle pressure is entirely explained by oil viscosity — cold oil is thick and resists flow through bearing clearances (producing high pressure), while hot oil at operating temperature thins to its designed viscosity and flows more easily through the same clearances (producing lower but still adequate pressure).

6. C — Blue smoke under sustained boost only — with no smoke at idle or light throttle — on a vehicle with a replaced turbocharger should first be investigated at the turbocharger oil drain line. [D] If the drain line is restricted (from carbon buildup, sludge from the previous turbo failure, or a kink from installation), oil cannot gravity-drain from the turbocharger center housing fast enough. The backed-up oil is forced past the turbine shaft seals by the positive pressure in the center housing, entering the exhaust and producing blue smoke that is most visible under boost when oil flow to the turbo is highest.

7. B — Both technicians are correct. [A] Technician A is right: when the gasket fails between two adjacent combustion chambers, compression leaks from each chamber into the other during its compression and power strokes, resulting in low compression readings on both affected cylinders. Technician B is right: when the gasket fails between a combustion chamber and a coolant passage, compressed air applied during a leak-down test passes through the breach into the coolant, producing visible bubbles in the coolant overflow tank.

8. D — A rebuilt engine with heavy blue smoke at all conditions, severe oil consumption (1 quart per 50 miles), and compression that is actually slightly higher than pre-rebuild readings points to a ring installation error rather than a mechanical failure. [C] Piston rings installed upside down (with the "TOP" marking facing the crankcase instead of the combustion chamber) reverse the designed face taper, causing the rings to actively pump oil upward into the combustion chamber rather than scraping it downward. The higher-than-expected compression confirms the bore was machined correctly and the rings are providing mechanical compression — they are simply oriented wrong.

9. B — A single audible click when the A/C compressor clutch engages is normal operation for an electromagnetic clutch. [A] The clutch consists of a friction disc that is pulled against the rotating pulley hub by an electromagnetic coil. When the coil is energized, the disc snaps against the hub with an audible click as the magnetic field bridges the air gap. This is a designed mechanical event, not a malfunction. The sound does not repeat because the clutch remains engaged continuously until the compressor cycles off.

10. A — An engine that stumbles specifically during the rapid transition from cruise RPM to idle — with normal compression and mechanical tests — has a throttle control or idle airflow problem rather than an engine mechanical issue. [A] When the throttle closes rapidly during deceleration, the idle air control valve or electronic throttle must immediately provide the correct bypass airflow to sustain idle combustion. If this response is too slow (dirty IAC, sluggish throttle motor, or stale PCM idle adaptation), the engine momentarily drops below the sustainable RPM before the correction catches up.

11. B — The corrected installed height of 1.700 inches falls at the upper limit of the 1.650 to 1.700 specification — it is within the acceptable range. [B] While it is at the maximum rather than the middle

of the specification, the spring will still provide adequate closing force at this height. The 0.030-inch shim correctly compensates for the excess height, and the valve will function within its designed parameters. A 0.060-inch shim would push the height to 1.670 — unnecessarily deeper into the range and potentially over-compressing the spring.

12. D — An oil filter with a lower bypass valve pressure rating than specified opens its bypass at a lower pressure differential than the correct filter. [E] This means that during normal operation — particularly during cold starts when oil is thick and filter differential pressure is naturally higher — the bypass opens prematurely and allows unfiltered oil to reach the bearings and valvetrain. The unfiltered oil carries particles that accelerate wear on hydraulic lifter check valves and plunger bores, eventually causing them to bleed down and produce the ticking noise.

13. C — An engine that runs hotter than normal only during low-speed city driving on hot days — while the fan engages and runs continuously — points to a cooling system that is operating at maximum capacity but cannot overcome the heat load under those specific conditions. [D] A partially restricted radiator has reduced heat rejection capacity. During highway driving, the high ram airflow compensates for the restriction. In slow city traffic on hot days — minimum airflow, maximum ambient temperature, frequent stopping — the restricted radiator cannot dissipate enough heat even with the fan running. The fan running continuously confirms the system is trying to cool but cannot keep up.

14. A — On a flat-tappet OHV engine, the cam lobe and its corresponding lifter wear as a matched pair — the lobe's taper and the lifter's convex crown work together to produce the rotation that distributes wear evenly. [B] When one lobe is worn significantly and the matching lifter has developed a concave face, both components must be replaced together. Installing a new lifter on the worn lobe (or vice versa) creates a mismatch that accelerates wear on the new component. Best practice is to replace the entire camshaft and all lifters as a complete set during any rebuild.

15. B — A two-second delay in oil pressure at restart after a four-hour sitting period, followed by rapid pressure buildup, indicates the oil filter is draining during the sitting period. [D] The anti-drain-back valve in the oil filter prevents oil from draining out of the filter when the engine is off. If this valve is missing, damaged, or the wrong filter type was used, the filter empties by gravity while the engine sits. On restart, the pump must refill the empty filter housing before pressurized oil reaches the gallery and gauge — this refill time accounts for the two-second zero-pressure delay.

16. D — An engine that idles smoothly with normal compression and vacuum but stumbles and backfires through the intake during acceleration is exhibiting a transient driveability problem — not a mechanical engine failure. [E] The normal idle readings confirm the engine is mechanically sound. The stumble during the rapid throttle transition points to an ignition or fuel delivery problem during the

transient event — a weak coil that misfires under the higher voltage demand of increased cylinder pressure, a fuel delivery hiccup, or a throttle position sensor glitch that momentarily disrupts the PCM's fueling calculation.

17. C — All four measurements on journal number 2 fall below the standard minimum specification of 2.4990 inches — the highest reading is 2.4989, which is 0.0001 inches below the minimum. [C] Regardless of how small the shortfall or how good the taper and out-of-round numbers are, the journal diameter is below the standard specification and standard bearings cannot achieve the correct oil clearance. The journal must be reground to the next undersize (0.010 under) and matching undersize bearings installed to restore proper clearance.

18. A — The block deck warpage of 0.002 inches is within the manufacturer's 0.004-inch maximum specification. [C] A block deck that meets the flatness specification does not require resurfacing. After thorough cleaning to remove all old gasket material and debris, the surface is ready for a new head gasket. Unnecessary resurfacing removes material that may be needed for future service and alters the deck height, which affects compression ratio and piston-to-head clearance.

19. B — A rhythmic vacuum fluctuation at a rate matching a single cylinder's firing frequency that disappears when that specific cylinder's injector is disabled confirms the affected cylinder is causing the disturbance. [A] The vacuum dip occurs each time cylinder 4 reaches its compression or power stroke because the valve is not sealing — compression leaks past the valve, momentarily reducing the cylinder's contribution and producing the vacuum dip. Disabling the fuel injector removes combustion from that cylinder entirely, eliminating the cyclic pressure variation that caused the fluctuation.

20. D — Elevated sodium and potassium in engine oil — elements characteristically found in coolant additive packages — indicate coolant is entering the oil. [D] The absence of visible symptoms (no white smoke, no milky oil, no overheating) means the coolant intrusion is extremely small — perhaps a few drops per heat cycle through a very minor head gasket breach, a hairline crack, or a slowly failing oil cooler. Oil analysis detects contamination at levels far below what produces visible symptoms, making it an early warning tool for developing problems.

21. D — A pushrod that bent during engine operation at 1,000 miles on a rebuilt engine — with a new camshaft and verified-correct rocker arm geometry — points to an internal hydraulic lifter defect. [B] If the lifter intermittently over-extends its plunger due to a stuck check valve or trapped debris, it effectively increases the valve opening force beyond what the pushrod is designed to withstand. The intermittent over-extension creates a momentary hydraulic overload that bends the pushrod. The defective lifter should be replaced and the pushrod replaced with a new one.

22. A — Both technicians are correct. [D] Technician A correctly describes the bypass valve's critical safety function: if the filter clogs, the bypass opens to ensure oil still reaches the bearings — no oil flow is far more damaging than unfiltered oil flow. Technician B correctly identifies the trade-off: when the bypass is open, the filter is no longer removing contaminants, and unfiltered oil carrying abrasive particles circulates through every bearing, accelerating wear. The bypass is a last-resort safety mechanism, not a normal operating condition.

23. C — A single clunk from the rear of the engine when shifting from Park to Drive only — not when shifting to Reverse — suggests the crankshaft shifts in one axial direction when the torque converter applies forward-gear load. [A] Excessive crankshaft end play allows the crankshaft to shift forward when the converter loads against it in Drive. The clunk is the crankshaft hitting the thrust bearing surface. The noise does not occur in Reverse because the axial load direction is different and the crankshaft is already against its opposite thrust surface from the Park-to-Drive shift.

24. B — A voltage reading of 14.2 volts unloaded that drops to 13.8 volts under full accessory load represents a normal 0.4-volt decrease that keeps the system within the 13.5 to 14.8 specification at all times. [E] This is exactly how a properly functioning charging system behaves — the alternator produces maximum voltage at low demand and slightly reduces output as electrical load increases. The steady 13.8-volt reading under load confirms the alternator has adequate output capacity and the voltage regulator is maintaining stable control.

25. D — An overheating condition with no consistent pattern — occurring at different speeds, loads, and durations — that cannot be reproduced despite all components testing functional points to an intermittent electrical fault in the temperature monitoring or fan control circuit. [D] A loose wire, corroded connector, or intermittent relay contact in the ECT sensor circuit or fan control circuit could randomly lose connection, causing the PCM to either misread the temperature or fail to command the fan. The random nature matches the unpredictable occurrence of an electrical intermittent.

26. A — All three findings converge on worn piston rings: the wet test showed significant improvement (95 to 140 PSI — a 45 PSI increase confirms the oil sealed the ring-to-bore gap), and the leak-down air was heard exclusively at the oil filler cap (confirming compressed air is passing the rings into the crankcase). [A] No air at the tailpipe, intake, or coolant eliminates valve and head gasket causes. The wet test improvement is the definitive confirmation — if rings were not the cause, oil could not have improved the seal so dramatically.

27. B — Both readings — 18 PSI at hot idle and 40 PSI at speed — are currently within the manufacturer's specifications (15 minimum at idle, 40 minimum at speed). [D] However, the gradually declining trend over the past year indicates progressive bearing wear that is slowly increasing oil

leakage through the clearances. The most appropriate response is to monitor the readings at each oil change, document the trend, and advise the customer that while no repair is needed now, the declining trend will eventually reach the specification limits and require attention.

28. D — Flat-tappet lifter faces are manufactured with a slight convex crown — typically 0.001 to 0.002 inches — that works with the cam lobe's slight taper to make the lifter rotate during operation. [B] A lifter that has worn flat has lost this convexity and will no longer rotate on the cam lobe. Without rotation, the contact between the lifter face and the cam lobe becomes a fixed-point wear pattern that rapidly destroys both the lifter and the lobe. The two flat-faced lifters must be replaced, and their corresponding cam lobes should be carefully inspected for matching wear.

29. A — A rear main seal that does not leak at idle but leaks under driving conditions is experiencing crankcase pressure that increases with engine load. [D] During driving, particularly during acceleration and higher RPM, the volume of blowby gases entering the crankcase increases above the idle level. While the PCV system handles this increased volume under normal conditions, even a properly functioning system experiences momentary pressure spikes during rapid throttle changes and load increases. If the seal installation is marginal, these pressure spikes are enough to force oil past the seal lip only during driving.

30. C — A negative smoke test does not guarantee a gasket is sealing perfectly — smoke tests have limitations in detecting very small leaks, leaks that only occur under vacuum (the smoke machine pressurizes the intake, which can actually push a marginally sealing gasket closed), or leaks that are intermittent. [A] A replacement intake manifold gasket on bank 1 that passed a smoke test but is associated with a persistent plus 22% fuel trim on that bank only is the most probable cause. The technician should remove and reinspect the gasket and mating surfaces, or spray propane around the gasket joint while monitoring fuel trim for changes.

31. C — The letter "T" stamped on a main bearing cap in addition to its position number identifies it as the thrust bearing cap — the cap that controls crankshaft end play through flanged thrust surfaces on either side of the bearing. [C] The thrust bearing cap is distinguished from the other main caps because it has the additional flanged surfaces that limit axial crankshaft movement. Knowing which cap is the thrust cap is critical during assembly because end play is adjusted at this specific bearing position.

32. B — A broken valve spring retainer found on top of the piston with very low compression on that cylinder indicates the valve has dropped into the combustion chamber. [B] The most likely failure sequence is that a valve lock (keeper) failed — either from fatigue, improper installation, or a manufacturing defect — which released the retainer and allowed the valve spring to push the retainer

upward while the valve fell downward into the cylinder. The unsupported valve cannot close, producing zero effective compression on that cylinder.

33. A — Back-pressure readings that are within specification during initial measurement but progressively climb when RPM is held steady confirm a partially restricted exhaust component that cannot handle sustained flow volume. [A] A catalytic converter with a partially melted or collapsed substrate passes low-volume exhaust adequately but gradually traps gas as sustained flow fills the restricted passages faster than it can exit. The progressive pressure rise during a sustained RPM hold is the diagnostic signature that distinguishes a partial restriction from a complete blockage.

34. D — A brief hesitation at the very first instant of throttle opening from idle — with all mechanical tests normal and no codes — is a fuel delivery transient problem, not an engine mechanical issue. [A] The PCM must deliver a precise fuel pulse at the instant the throttle begins to open (the "tip-in" enrichment) to prevent a lean stumble during the rapid transition from idle to acceleration. If this tip-in calibration is slightly lean, the accelerator pump is sluggish (on carbureted engines), or the throttle body has carbon deposits that delay initial airflow, the momentary lean condition produces the hesitation.

35. B — Many connecting rods have a small oil squirt hole drilled through the beam that is designed to direct a stream of oil upward toward the cylinder wall and piston underside during operation. [C] If the rod is installed backwards, this hole faces away from the bore wall and the oil stream misses its target. The affected cylinder receives less splash lubrication on the bore wall (increasing ring and bore wear) and less cooling oil on the piston underside (increasing piston temperature and detonation risk). The rod must be corrected to its proper orientation.

36. C — The scan tool data directly correlates each hesitation event with a spike in EVAP purge duty cycle. [E] A saturated EVAP charcoal canister releases a concentrated bolus of fuel vapor when the purge valve opens. This vapor surge enters the intake manifold as a sudden rich mixture addition that momentarily disrupts the calibrated cruise air-fuel ratio. The PCM's fuel trim system is too slow to react to the instantaneous vapor bolus, producing the brief hesitation before the mixture normalizes.

37. A — A very faint blue tint visible only against a white background in direct sunlight, with stable oil level and all tests passing, is consistent with minor residual assembly oil or break-in ring seating that produces trace amounts of oil vapor in the exhaust. [A] At 100 miles on a rebuilt engine, the rings are still in the early stages of seating against the freshly honed bore. A trace amount of oil passing the not-yet-fully-seated rings is expected and typically diminishes as the break-in progresses. The appropriate action is to document the observation and recheck at 500 miles.

38. C — Rapid oil darkening within 200 miles of an oil change, with normal wear metals on oil analysis and no engine symptoms, is completely normal engine operation. [E] Engine oil is formulated with dispersant additives that absorb and suspend combustion byproducts — carbon, soot, and acidic compounds — keeping them in suspension rather than allowing them to deposit on engine surfaces. This suspension process causes the oil to darken. The rate of darkening varies by engine condition, fuel quality, and driving patterns, but color change within a few hundred miles is not abnormal.

39. D — A fluttering sound from the engine during closed-throttle deceleration only — absent at idle and during acceleration — points to an exhaust valve that is not fully closing under the specific conditions of deceleration. [A] During deceleration with the throttle closed, intake manifold vacuum is at its highest. A valve with a weak spring or a deposit preventing full closure may vibrate or flutter as the high vacuum pulls against it during each valve event. The flutter produces a rhythmic sound that is unique to the deceleration condition and stops when the throttle opens and vacuum drops.

40. B — The quick diagnostic findings — compression within specification, vacuum at 17 in. Hg (lower end of normal), oil pressure at 22 PSI at hot idle, no unusual noises, clean oil — suggest a serviceable engine that is not in distress. [A] However, these are screening tests only. A thorough evaluation would include a wet compression test, leak-down test, detailed noise assessment under load, oil analysis, cooling system integrity check, and inspection of the timing components and valvetrain. The quick tests provide a reasonable initial impression but are insufficient for a confident purchase decision.

41. D — A valve-to-seat contact pattern that shows 270 degrees of contact with a 90-degree gap indicates the valve is not sitting concentrically on the seat. [B] The most likely cause is that the seat cutter pilot was not properly centered in the valve guide bore during the cutting operation, producing a seat that is slightly eccentric — offset from the guide centerline. When the valve (which is guided by the centered guide) sits on the eccentric seat, contact is uneven. The seat must be recut with a properly centered pilot.

42. D — An engine that nearly stalls only when three loads are combined simultaneously — idling in gear, A/C compressor running, and brake pedal pressed — is experiencing a condition where the total parasitic and vacuum demand exceeds the engine's idle reserve power. [A] The A/C compressor places a mechanical load on the crankshaft, the transmission in Drive creates a torque converter load, and the brake booster draws significant vacuum from the manifold when the pedal is pressed. Each load individually is manageable, but the combination overwhelms the idle speed control's ability to maintain sufficient RPM.

43. B — A P0304 misfire with coolant-fouled plug, very low compression on cylinder 4, and a positive block test immediately after a head gasket replacement confirms the new gasket is not sealing at the

cylinder 4 location. [B] The replacement gasket may have been installed with incorrect orientation, may have shifted during head installation, may have been damaged by debris on the mating surface, or may be defective. The technician must remove the head, inspect the gasket and both deck surfaces, and reinstall with meticulous attention to surface preparation and gasket alignment.

44. B — When the oil level drops three quarts, the reduced oil volume means the oil galleries — which are normally kept full by the pump — partially drain because the pump draws the reduced supply down below the gallery feed points. [D] On restart after adding oil, the pump must refill the galleries from the pan upward. The lifters closest to the pump (nearest the main oil gallery entry) receive oil first and pump up quickly. The lifters at the far ends of the gallery network — the last to receive flow — take the longest to fill, producing the staggered noise resolution pattern.

45. A — Both technicians are correct and describe complementary aspects of the same diagnosis. [A] Technician A correctly identifies that 50% leak-down with air only at the oil filler cap confirms the piston rings are the leak path — air is passing the rings into the crankcase. Technician B correctly adds that the companion compression test should show low compression that improves significantly on a wet test, which provides the second confirmation. Both the leak-down path and the wet test improvement must agree to form a confident ring wear diagnosis.

46. D — Only cylinder 4 exceeds the taper and out-of-round specifications, so only cylinder 4 requires boring. [C] The remaining five cylinders are well within specification and can be reused with a light hone and standard-size rings. Boring all six cylinders when only one is out of specification wastes serviceable cylinder wall material. However, the technician must use an oversize piston in cylinder 4 that matches the bored dimension while using standard pistons in the other five cylinders.

47. B — A low-frequency groaning or moaning sound at hot idle only — not present cold, absent above 1,000 RPM, and persisting after replacing the belt, tensioner, and pulleys — points to the harmonic balancer as the remaining vibration-related component. [A] At hot idle, the engine runs at its lowest stable RPM, and the torsional vibrations from the firing pulses are at their most pronounced. If the balancer's rubber element has deteriorated from heat and age, it can no longer dampen these vibrations effectively, and the engine produces a resonant moaning at the idle frequency that disappears when RPM increases.

48. C — Brown, slimy coolant in a system documented as having regular service with Dex-Cool strongly suggests coolant incompatibility — at some point, a non-compatible coolant type (such as conventional green IAT) was mixed with the Dex-Cool (OAT). [D] Mixing IAT and OAT coolant chemistries causes the additive packages to react and gel, producing the brown slimy deposits and murky discoloration. The customer's service records may show correct intervals, but the records may not

specify which coolant type was used at each service — and a single incorrect coolant type introduced at any service can contaminate the system.

49. A — A slight fuel odor in engine oil at the full mark (not elevated) on a rebuilt engine driven primarily in short cold-weather city trips is most consistent with fuel condensation from incomplete combustion during cold operation. [A] During cold starts and short trips, the rich cold-start fuel mixture does not burn completely, and a small amount of unburned fuel washes past the rings into the crankcase. On a fully warmed engine driven for sustained periods, the oil temperature rises enough to evaporate the fuel through the PCV system. Short trips in cold weather prevent this evaporation, allowing fuel to accumulate gradually.

50. D — Crankshaft end play of 0.014 inches exceeds the maximum specification of 0.010 inches by 0.004 inches, confirming the thrust bearing surfaces are worn and cannot limit axial movement to the designed range. [C] The correct repair is to replace the thrust bearing with a new standard unit — or if the thrust surfaces on the crankshaft are also worn, an oversize thrust bearing that compensates for both the bearing and crankshaft wear. The thrust bearing is the sole component responsible for controlling end play, and its replacement directly addresses the excessive measurement.