PRACTICE EXAM 10: ASE A1 ENGINE REPAIR SIMULATION (50 QUESTIONS)

1. A technician is diagnosing an engine with a single-cylinder misfire at idle. The compression test shows the affected cylinder at 142 PSI while all others read 150 to 158 PSI. The manufacturer's minimum is 140 PSI. A wet test on the affected cylinder raises the reading to 148 PSI. A leak-down test shows 12% leakage with faint air audible at the oil filler cap. All ignition and fuel components have been swapped and the misfire remains. Which of the following is the correct interpretation?

A. The compression and leak-down readings confirm a severe mechanical failure causing the misfire

B. The cylinder has a head gasket breach to a coolant passage that is causing the idle misfire

C. The wet test improvement proves the rings are the sole cause and a rebuild is required immediately

D. The readings are borderline and the slight ring wear may contribute to a marginal misfire at idle only

2. A customer reports that the engine produces a brief whiff of white smoke from the exhaust every morning on cold start that disappears within 30 seconds. The smoke does not return during driving. Coolant level has remained stable for three months. The engine oil appears clean. Which of the following BEST explains this condition?

A. Normal condensation in the exhaust system that vaporizes as the exhaust warms up after cold start

B. A very small head gasket breach that leaks only when components are cold and contracted

C. Coolant seeping past the intake manifold gasket and pooling in the intake port overnight

D. A worn valve stem seal that is allowing a small amount of coolant past the valve guide

3. A technician connects a vacuum gauge to the intake manifold on a running engine. At idle, the needle holds steady at 20 in. Hg. When the throttle is snapped wide open briefly and released, the vacuum drops to 2 in. Hg, then overshoots to 24 in. Hg on deceleration before settling back to 20 in. Hg at idle. Which of the following does this pattern indicate?

A. The engine has a partially restricted exhaust that limits vacuum recovery after acceleration

B. The engine is mechanically healthy with normal vacuum responses at all throttle conditions

C. The intake manifold has a small crack that only leaks under the rapid pressure changes of throttle snap

D. The engine has retarded ignition timing that delays the vacuum recovery during the snap throttle test

4. An engine block is being inspected during a rebuild. The technician finds that the number 2 cylinder bore has a vertical score line approximately 0.006 inches deep running three-quarters of the bore length. All other bores are smooth and undamaged. The standard bore diameter is 3.780 inches. Which of the following is the correct repair for cylinder 2?

A. Hone the bore with an aggressive stone to blend the score into the surrounding surface finish

B. Fill the score with a high-temperature metallic epoxy and then hone the bore to final dimension

C. Bore cylinder 2 to the next oversize to remove the scoring and install a matching oversize piston

D. Install a cylinder sleeve into the bore to create a new bore surface without changing the bore size

5. Technician A says that on an engine with a serpentine belt-driven water pump, a slipping belt can simultaneously cause undercharging and reduced coolant circulation. Technician B says that a serpentine belt that is too tight can cause premature failure of the water pump bearing and alternator bearing. 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

6. A six-cylinder engine produces a rhythmic thumping noise at idle that is most noticeable from underneath the vehicle near the oil pan. The noise does not change when individual cylinders are disabled. Oil pressure is 12 PSI at hot idle — the minimum specification is 15 PSI. At 2,000 RPM, the pressure rises to 35 PSI and the noise diminishes significantly. Which of the following diagnosis is MOST consistent with ALL of these findings?

A. A loose flywheel or flexplate that thumps against the torque converter at idle rotational speed

B. A worn oil pump that cannot maintain pressure and produces cavitation noise at lower speeds

C. A broken motor mount that allows the engine to contact the subframe during idle vibration

D. Worn main bearings with insufficient oil pressure at idle to maintain the hydrodynamic oil film

7. A customer reports that the engine intermittently surges between 700 and 1,100 RPM at idle. The surging occurs approximately once every 20 seconds and lasts about 3 seconds before the idle stabilizes. No codes are stored. Compression is within specification on all cylinders. Which of the following is the MOST likely cause?

A. A worn camshaft lobe that intermittently reduces valve lift on one cylinder causing RPM swings

B. A small vacuum leak that the PCM's fuel trim corrections alternately overcompensate and undercompensate for

C. Worn piston rings on one cylinder that intermittently lose their seal and allow blowby at idle

D. An exhaust restriction that periodically builds and releases back-pressure causing RPM fluctuations

8. A technician is replacing a timing chain on a V6 engine. After installing the new chain and aligning all timing marks, the technician rotates the engine by hand two full revolutions. On the second revolution, the engine becomes noticeably harder to turn at one specific point in the rotation. The engine has an interference valvetrain design. Which of the following is the MOST likely cause?

A. The timing chain tensioner has not fully extended and is binding against the chain at one point

B. The new timing chain is slightly shorter than specification and is creating tension at full wrap

C. A valve is making contact with a piston crown at one specific camshaft position during the rotation

D. Normal rotational resistance variation from compression events on different cylinders during hand rotation

9. A vehicle's engine cranks normally but takes approximately 15 seconds of cranking to start every morning. Once started, the engine runs perfectly all day with immediate restarts. Fuel pressure at key-on reads 25 PSI, which is below the 55 PSI specification. After the pump runs for three seconds, pressure reaches 55 PSI and the engine starts. Which of the following is the MOST likely cause?

A. A leaking fuel pump check valve or injector that allows fuel pressure to bleed down overnight

B. A clogged fuel filter that restricts flow during the high-demand period of initial cranking

C. A failing fuel pump motor that requires several seconds to reach full speed and pressure output

D. A faulty fuel pressure regulator that vents fuel back to the tank during the key-off overnight period

10. A technician is performing a cylinder head inspection after removal from an overheated engine. Dye penetrant testing reveals a crack running between the number 3 and number 4 exhaust valve seats on the bottom deck surface. The crack extends approximately 1.5 inches and is visible without magnification after the developer is applied. Which of the following is the correct action?

A. Weld-repair the crack using a specialized aluminum welding process and then resurface the head

B. Pin the crack using threaded pins to prevent propagation and then resurface the deck surface

C. Resurface the head to remove the cracked layer since it appears to be a shallow surface crack

D. Replace the cylinder head because a crack between exhaust valve seats cannot be reliably repaired

11. A four-cylinder engine has the following compression results: Cyl 1 = 170, Cyl 2 = 175, Cyl 3 = 165, Cyl 4 = 172 PSI. The manufacturer's specification is 140 to 165 PSI. All readings exceed the maximum specification. The engine has 95,000 miles and runs normally with no performance complaints. Which of the following is the MOST likely cause of the above-specification readings?

A. The compression gauge is reading incorrectly high and needs to be calibrated before use

B. The engine was recently rebuilt with high-compression pistons that were not factory specified

C. Excessive carbon buildup in the combustion chambers has reduced chamber volume and raised the compression ratio

D. The cylinder bores have worn into a taper pattern that actually increases compression at the top

12. A technician is performing a starter current draw test on a V6 engine with the ignition and fuel systems disabled. The ammeter reads 95 amps during cranking. The specification for this engine is 120 to 180 amps. The engine cranks faster than normal. Which of the following BEST explains the low current draw and fast cranking speed?

A. The battery is overcharged and delivering excessive voltage that speeds up the starter motor

B. The engine has very low compression on multiple cylinders and offers less resistance to cranking

C. The starter motor windings have a partial short that increases efficiency and reduces current draw

D. The engine oil viscosity is too thin for the ambient temperature and reduces internal friction

13. A customer brings in a vehicle with a complaint that the heater blows cold air. The engine reaches operating temperature normally and the temperature gauge reads in the normal range. Both heater hoses at the firewall feel equally hot. Which of the following is the MOST likely cause?

A. A thermostat that is stuck in the partially open position reducing coolant temperature delivery

B. A water pump with a failing impeller that cannot circulate enough coolant through the heater core

C. A coolant level that is slightly low and allowing air to enter the heater core during operation

D. A blend door actuator failure inside the HVAC system that is directing air past the heater core

14. Technician A says that when measuring crankshaft journal taper, measurements should be taken at two points along the length of the journal in the same direction. Technician B says that taper is calculated as the difference between the largest and smallest measurements taken in perpendicular directions at the same point. Who is correct?

A. Technician A only

B. Technician B only

C. Both Technician A and Technician B

D. Neither Technician A nor Technician B

15. A rebuilt engine develops a persistent oil leak at the front crankshaft seal within 500 miles of completion. The seal was new and properly installed using the manufacturer's recommended installation tool. The PCV system is functioning correctly and crankcase pressure is normal. The crankshaft snout was inspected during the rebuild and showed no visible groove or wear. Which of the following should the technician investigate NEXT?

A. The oil pump pressure output to determine if excessive pressure is blowing out the seal

B. The alignment of the harmonic balancer to verify it is not running eccentric on the snout

C. Whether the new seal was installed at the correct depth and orientation per the manufacturer

D. Whether the timing cover that houses the seal was warped or damaged during the rebuild

16. An engine makes a ticking noise that is only audible through the stethoscope when the probe is placed on the fuel rail. The noise tracks with engine RPM but is not audible through the valve cover, timing cover, or oil pan. Which of the following is the MOST likely source?

A. A hydraulic lifter that is bleeding down and producing a tick transmitted through the head to the rail

B. A worn timing chain guide that is vibrating and transferring noise through the block to the fuel rail

C. A loose fuel rail mounting bolt that is allowing the rail to vibrate against the intake manifold surface

D. Normal fuel injector clicking that is conducted through the metal fuel rail body to the stethoscope

17. A technician is evaluating whether to bore a cylinder or install a sleeve. The engine is a rare classic vehicle and maintaining the original block is important to the customer. The number 4 bore has severe scoring and would require boring to 0.060-inch oversize to clean up — but the maximum recommended oversize is 0.040 inches. Which of the following is the correct recommendation?

A. Install a cylinder sleeve to restore the bore to standard diameter while preserving the original block

B. Bore to 0.060-inch oversize despite exceeding the limit because the scoring must be fully removed

C. Bore to 0.040-inch oversize even though some scoring will remain visible in the finished bore

D. Replace the engine block because exceeding the maximum bore limit makes the block unusable

18. A vehicle with a turbocharged engine is brought in after the owner noticed oil pooling in the intercooler piping. There are no leaks from the turbocharger drain line, and the turbocharger shaft has no measurable play. The engine consumes no noticeable oil between changes. The PCV system connects to the intake tract upstream of the turbocharger compressor inlet. Which of the following is the MOST likely source of the oil in the intercooler piping?

A. The turbocharger compressor seal is leaking oil into the intake tract under boost conditions

B. Normal PCV system oil vapor that enters the intake, passes through the compressor, and condenses in the cooler intercooler piping

C. The intercooler itself is leaking internally from a cracked internal passage that contains oil

D. Blowby gases are being pushed through the crankcase breather into the intake at excessive volume

19. Technician A says that an engine with a cracked exhaust manifold can produce a false lean reading on the upstream oxygen sensor. Technician B says that a cracked exhaust manifold upstream of the oxygen sensor can cause the PCM to enrich the fuel mixture unnecessarily. 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

20. A technician is diagnosing a six-cylinder engine that has a noticeable power loss. A compression test shows all cylinders between 100 and 110 PSI. The specification is 145 to 165 PSI. A vacuum gauge reads a steady 14 in. Hg at idle at sea level. No individual cylinder stands out — the compression loss is uniform. A wet test shows improvement of 15 to 20 PSI on all cylinders. Which of the following combinations of findings MOST accurately describes this engine's condition?

A. The engine has a valve timing problem combined with worn piston rings on all cylinders

B. The engine has generalized ring and bore wear and the low vacuum confirms the reduced compression

C. The engine has a head gasket failure on multiple cylinders combined with worn valve guides

D. The uniformly low compression is caused by a restricted exhaust system reducing cylinder filling

21. A technician removes the spark plugs from a V8 engine as part of a tune-up. Six of the eight plugs show a normal tan color. The plug from cylinder 5 is heavily oil-fouled with wet black deposits. The plug from cylinder 6 appears steam-cleaned and white with small crystalline deposits. Which of the following is the correct interpretation of these two plugs?

A. Cylinder 5 has an ignition system problem and cylinder 6 has a fuel delivery problem

B. Cylinder 5 has oil entering its combustion chamber and cylinder 6 has coolant entering its chamber

C. Both cylinders 5 and 6 have the same head gasket failure manifesting with different symptoms

D. Cylinder 5 has excessive fuel delivery and cylinder 6 has insufficient fuel delivery from the injector

22. A rebuilt engine has been running for 10,000 miles with no problems. The customer brings the vehicle in for a routine oil change. During the change, the technician cuts open the oil filter and finds a small amount of fine, dark metallic particles on the filter media — less than what was present at the 500-mile break-in change. The engine sounds normal and oil pressure is within specification. Which of the following is the correct interpretation?

A. The decreasing particle count indicates normal wear-in progression and the engine is healthy

B. Any metallic particles at 10,000 miles indicates a bearing failure in progress and requires attention

C. The particles are residual from the break-in period that were trapped in oil passages and just released

D. The dark color of the particles indicates camshaft lobe wear rather than normal bearing break-in

23. A vehicle is brought in because the engine temperature gauge rises to three-quarters during stop-and-go traffic but drops back to normal at highway speed. The electric cooling fan does not come on when the temperature rises. The technician applies direct battery power to the fan motor and it spins normally. Which of the following is the MOST likely cause?

A. A faulty PCM that is not sending the fan relay command signal at the correct temperature

B. A failed fan motor that works when tested directly but cannot sustain operation under load

C. A failed coolant temperature sensor, fan relay, or fan relay circuit preventing fan activation

D. A water pump with a partially failed impeller that cannot circulate coolant at low idle RPM

24. A technician is replacing a head gasket on a DOHC engine. During reassembly, the technician discovers that one of the twelve head bolt holes in the block has coolant standing in the bottom. The bolt hole does not intersect any coolant passage according to the manufacturer's specifications. Which of the following is the MOST likely explanation?

A. Residual coolant from the block washing process that was not fully dried before assembly began

B. A head bolt thread sealant that has dissolved and is now appearing as liquid in the bolt hole

C. Normal condensation from the temperature difference between the block and the shop environment

D. A crack between a coolant passage and the bolt hole that is allowing coolant to migrate through

25. An engine with a known VVT system fault produces a check engine light with code P0011 (intake camshaft timing over-advanced, bank 1). The engine has a rough idle and poor low-speed performance but runs acceptably at higher RPM. The customer reports that oil changes have been performed every 12,000 miles with conventional oil. The manufacturer specifies 5,000-mile intervals with full synthetic. Which of the following should the technician recommend as the FIRST repair step?

A. Replace both intake and exhaust VVT cam phasers on bank 1 because they are likely worn out

B. Change the oil and filter with the correct specification, replace the VVT oil control valve on bank 1, and clear the code

C. Perform a complete timing chain replacement because VVT codes indicate the chain has stretched

D. Replace the PCM because it is likely sending incorrect signals to the VVT solenoid on bank 1

26. Technician A says that measuring connecting rod big-end bore diameter should be done with the rod cap torqued to specification. Technician B says that connecting rod big-end bore diameter should be measured with the cap removed to inspect the bore halves individually. 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

27. A technician is breaking in a rebuilt engine and notices that the oil pressure drops from 60 PSI to 50 PSI during the first 500 miles of operation. All bearing clearances were verified during assembly and were at the middle of the specification range. Oil level and viscosity are correct. The engine runs quietly with no abnormal noises. Which of the following BEST explains this pressure decrease?

A. The oil pump relief valve spring is weakening prematurely and releasing pressure too early

B. The oil filter bypass valve is opening intermittently and allowing unfiltered oil to reduce pressure

C. Normal bearing surface break-in wear that slightly increases clearances and allows marginally more oil flow

D. The oil pump gears are wearing rapidly because they were contaminated during the assembly process

28. A V8 engine exhibits a condition where cylinder 7 consistently fouls its spark plug with dry, fluffy black carbon deposits. The plug is replaced and fouls again within 1,000 miles. All other cylinders' plugs are a normal tan color. Compression on cylinder 7 is 150 PSI — within specification. Fuel injector flow testing shows the cylinder 7 injector delivers 10% more fuel than the others. Which of the following is the MOST likely cause of the plug fouling?

A. A burned exhaust valve on cylinder 7 that prevents complete combustion of the fuel charge

B. A weak ignition coil on cylinder 7 that cannot fully ignite the fuel under all operating conditions

C. A vacuum leak at the cylinder 7 intake runner that causes a lean misfire and incomplete combustion

D. The cylinder 7 fuel injector is over-delivering fuel, creating a rich condition that fouls the plug

29. A technician is installing new freeze plugs during an engine rebuild. The block has been cleaned and all freeze plug bores have been inspected. One bore on the right side of the block shows moderate pitting from corrosion — the surface is rough but the bore diameter is still within the standard plug size range. Which of the following is the MOST appropriate action?

A. Apply a thin layer of thread sealant around the standard plug to fill the minor pitting voids

B. Install a standard freeze plug and rely on the press-fit interference to seal despite the pitting

C. Use a sealing compound on the plug perimeter and install a standard plug to account for the pitting

D. Install a slightly oversize plug or a threaded expansion plug to compensate for the pitted surface

30. A technician is diagnosing an engine that hesitates and stumbles during the first five minutes of cold operation but runs perfectly once fully warmed up. No codes are stored. A compression test performed while the engine is cold shows all cylinders between 130 and 138 PSI. A compression test performed when the engine is at full operating temperature shows all cylinders between 148 and 155 PSI. The specification is 145 to 165 PSI. Which of the following BEST explains the cold hesitation?

A. The engine has worn valve guides that only leak oil during cold operation when clearances are widest

B. The cold compression readings are below specification due to wider ring and bore clearances at cold temperature

C. The thermostat is opening too early during cold operation, overcooling the engine and affecting combustion

D. The ignition timing is retarded during cold operation by the PCM and causes the hesitation until warm

31. Technician A says that a connecting rod that has been reconditioned by resizing the big end (machining the cap mating surface and re-boring to specification) should be checked for correct rod length afterward. Technician B says that resizing the big end removes material from the cap, effectively shortening the center-to-center distance of the rod. 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

32. An engine that has been running normally for 50,000 miles since its last timing belt replacement suddenly develops a rough idle, loss of power, and a flashing check engine light. A compression test shows cylinders 1 and 2 at 40 PSI, cylinder 3 at 145 PSI, and cylinder 4 at 148 PSI. The engine is an interference design. Which of the following is the MOST likely cause?

A. Two burned exhaust valves on cylinders 1 and 2 that failed from normal wear simultaneously

B. A head gasket failure between cylinders 1 and 2 that is allowing compression to cross-leak

C. Two cylinders with severely worn piston rings that both failed at approximately the same time

D. The timing belt has jumped teeth on the intake camshaft, bending valves on cylinders 1 and 2

33. A technician discovers during a cooling system inspection that the coolant in the recovery tank is a murky brown color with visible particles floating in it. The engine does not overheat and runs normally. The last coolant service was performed two years ago at the correct interval. Which of the following is the MOST likely cause of the discolored coolant?

A. A failing water pump impeller that is shedding material into the coolant circulation path

B. Internal corrosion from either a depleted coolant additive package or mixed incompatible coolant types

C. A head gasket failure that is slowly leaking combustion gases into the coolant and creating deposits

D. Normal coolant discoloration from two years of service that does not indicate any system problem

34. A technician is measuring the bore on a six-cylinder engine. Cylinder 3 shows the following measurements: top of bore perpendicular to crank = 3.7820 inches, top of bore parallel to crank = 3.7815 inches, bottom of bore perpendicular to crank = 3.7808 inches, bottom of bore parallel to crank = 3.7806 inches. What are the taper and maximum out-of-round values for this cylinder?

A. Taper = 0.0012 inches, Out-of-round = 0.0007 inches — both may exceed specification

B. Taper = 0.0005 inches, Out-of-round = 0.0002 inches — both are likely within specification

C. Taper = 0.0014 inches, Out-of-round = 0.0005 inches — taper is the larger concern

D. Taper = 0.0009 inches, Out-of-round = 0.0005 inches — both require investigation

35. A customer reports that after parking on a steep uphill driveway overnight, the engine has difficulty starting the next morning. When parked on flat ground, the engine starts immediately. No codes are stored. Fuel pressure, compression, and ignition are all normal when tested in the shop on level ground. Which of the following is the MOST likely explanation?

A. The fuel tank pickup is positioned such that fuel drains away from it when the vehicle is tilted steeply uphill

B. The engine oil pools toward the rear of the pan on the incline and starves the oil pump on start

C. The battery acid shifts inside the battery on the incline and momentarily reduces cranking power

D. The coolant level drops below the temperature sensor on the incline and delays the cold start fueling

36. A technician is checking the oil level on a vehicle during a routine service and notices that the oil level on the dipstick is approximately one quart above the full mark. The customer states no oil has been added. The oil does not smell like fuel and appears normal in color and consistency. The vehicle is equipped with a liquid-cooled engine oil cooler. Which of the following is the MOST likely cause of the elevated oil level?

A. A leaking head gasket that is allowing combustion gas to pressurize the crankcase and push oil up

B. A failed engine oil cooler that is allowing coolant to leak into the crankcase and raise the oil level

C. The dipstick is an incorrect application and is reading higher than the actual oil level indicates

D. A failing PCV valve that has increased crankcase pressure and pushed oil toward the dipstick tube

37. A technician discovers that an engine's oil drain-back holes in the cylinder head are partially clogged with sludge. The engine has been experiencing higher-than-normal oil consumption. Which of the following explains how clogged drain-back holes contribute to oil consumption?

A. Clogged drain-backs cause oil to accumulate in the valve cover area and flood the valve stems

B. Clogged drain-backs reduce oil flow to the bearings and cause them to overheat and leak

C. Clogged drain-backs create excessive crankcase pressure that forces oil past the piston rings

D. Oil that cannot drain back accumulates around the valve stems and guides, increasing the volume of oil available to leak past the seals into the ports

38. Technician A says that an engine coolant system should be filled slowly to minimize the amount of trapped air. Technician B says that many modern engines have bleeder screws or valves specifically designed to purge air from the cooling system during filling. 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

39. A technician is diagnosing a vehicle with a complaint of a sulfur smell from the exhaust under hard acceleration. The engine runs normally with no misfire codes. A scan tool shows short-term fuel trim swinging from minus 5% to plus 3% during normal driving but showing minus 12% during hard acceleration. Which of the following is the MOST likely cause of the sulfur smell?

A. A failing catalytic converter that cannot process the exhaust gases efficiently under high load

B. A head gasket leak that allows coolant into the exhaust producing the sulfur-like sweet smell

C. A rich fuel condition during hard acceleration that produces hydrogen sulfide in the catalytic converter

D. Contaminated fuel with a high sulfur content that is being burned and expelled in the exhaust

40. A technician is inspecting the connecting rod bolts on a high-mileage engine during a rebuild. The engine uses conventional (non-TTY) rod bolts. The bolts appear to be in good condition with no visible damage. The technician measures each bolt's length and finds all bolts are within 0.001 inches of the manufacturer's new-bolt specification. Which of the following is the correct action?

A. Replace all rod bolts as a precaution because they have been subjected to repeated stress cycles

B. Reuse the bolts that measure within specification and replace only any that are stretched or damaged

C. Replace all rod bolts because conventional rod bolts cannot be reused regardless of condition

D. The bolts can be cleaned, inspected for thread damage, and reused if they meet the length specification

41. A four-cylinder engine with 160,000 miles has a slight but steady oil drip from the front of the engine. After cleaning, the technician traces the oil to the valve cover gasket on the left side — the gasket is seeping at one corner. The customer also mentions that the engine uses about one quart of oil every 3,000 miles. Which of the following is the MOST appropriate repair approach?

A. Replace only the valve cover gasket since the oil consumption rate is within acceptable limits for this mileage

B. Rebuild the entire top end of the engine including valve guides, seals, and the valve cover gasket

C. Replace the valve cover gasket and the valve stem seals simultaneously since the head is accessible

D. Replace the valve cover gasket and recommend an engine oil additive to reduce the oil consumption rate

42. A technician is diagnosing a V6 engine with a vacuum gauge. At idle, the reading is a steady 18 in. Hg. When the engine is held at 2,000 RPM for 30 seconds, the vacuum reading starts at 18 in. Hg and gradually decreases to 13 in. Hg over the 30-second period. When the RPM is released back to idle, the vacuum immediately returns to 18 in. Hg. Which of the following is the MOST likely cause?

A. Worn valve guides that allow increasing oil seepage past the valves at sustained higher RPM

B. A restricted exhaust system that progressively builds back-pressure as exhaust flow volume increases

C. A failing fuel pump that gradually loses fuel pressure under the sustained demand of higher RPM

D. Worn piston rings that gradually lose their seal as oil film dynamics change at sustained higher RPM

43. A customer reports that the engine makes a loud clunking noise once when the transmission is shifted from Park to Drive, and once when shifted from Drive to Reverse. The noise comes from the rear of the engine area. It does not repeat while driving in either gear. Which of the following is the MOST likely cause?

A. Worn transmission mount bushings that allow the drivetrain to shift excessively during gear changes

B. A loose or cracked torque converter that shifts position when the transmission engages each gear

C. A loose starter motor mounting bolt that allows the starter to shift when engine torque changes direction

D. Excessive crankshaft end play that allows the crankshaft to shift fore and aft when drivetrain load reverses

44. A technician is testing a radiator cap on a vehicle with an intermittent overheating complaint. The cap is rated at 16 PSI. When tested, the cap holds pressure and releases at exactly 16 PSI. However, when the technician tests the cap's vacuum valve by applying gentle suction, the vacuum valve does not open. Which of the following consequences will this stuck vacuum valve cause?

A. The upper radiator hose may collapse when the engine cools because coolant cannot be drawn back from the overflow tank

B. The engine will overheat because the stuck vacuum valve prevents coolant from reaching the radiator

C. The cooling fan will run continuously because the PCM detects a vacuum condition in the radiator

D. The coolant will boil at a lower temperature because the vacuum reduces the effective system pressure

45. A six-cylinder engine has a misfire on cylinder 4 that is present at all speeds and loads. A compression test shows cylinder 4 at 60 PSI while all others are between 150 and 158 PSI. A wet test raises cylinder 4 to 65 PSI. A leak-down test on cylinder 4 shows 50% leakage. Air is audible at the intake manifold opening and simultaneously at the oil filler cap. Which of the following BEST explains simultaneous leakage at two locations?

A. A single massive head gasket failure that has breached both the intake port and an oil return passage

B. A dropped valve seat that has fallen into the combustion chamber and also damaged a piston ring

C. A cracked cylinder head that is leaking through two separate crack paths simultaneously at cylinder 4

D. Both the intake valve and the piston rings have failed independently on cylinder 4 at the same time

46. Technician A says that the ignition system should be disabled before performing a compression test to prevent the engine from starting. Technician B says that the fuel system should be disabled before performing a compression test to prevent fuel from being injected during cranking. 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

47. A customer brings in a vehicle reporting that after an aftermarket performance air intake was installed, the check engine light came on with a P0171 (system too lean) code. The engine runs slightly rougher at idle than before the intake installation. Compression and mechanical tests are all normal. Which of the following is the MOST likely cause?

A. The aftermarket intake has an air leak past the mass airflow sensor that introduces unmetered air

B. The aftermarket intake filter is too restrictive and is limiting airflow below the engine's demand

C. The performance intake is flowing too much air for the fuel system to compensate at idle speeds

D. The aftermarket intake installation damaged the throttle body gasket creating a vacuum leak

48. A technician notices that the exhaust from a vehicle has a persistent grayish-white tint during normal driving that is more visible in cold weather. The coolant level has remained stable. The oil appears normal. A block test is negative. The engine has 200,000 miles. Which of the following BEST explains this exhaust appearance?

A. A very small head gasket breach that only leaks enough coolant to tint the exhaust but not drop the level

B. Normal water vapor condensation in the exhaust system that is more visible in cold ambient temperatures

C. A catalytic converter that is breaking down internally and releasing its wash-coat material as particles

D. Minor oil consumption that produces a grayish tint rather than the typical blue when quantities are very small

49. A freshly rebuilt engine is being started for the first time. The technician pre-lubricated the system using a priming tool. The engine starts immediately and oil pressure reaches 55 PSI within three seconds. After 30 seconds of running at 1,500 RPM, a single hydraulic lifter begins ticking on cylinder 3. The tick continues for five minutes without stopping. Which of the following should the technician do?

A. Continue running the engine for up to 30 minutes because lifter tick on a rebuilt engine is always temporary

B. Shut the engine off and allow it to sit for one hour to let the lifter pressurize from residual oil gallery pressure

C. Rev the engine to 3,000 RPM for 15 seconds to increase oil flow and force-fill the lifter plunger

D. Shut the engine off, remove the cylinder 3 rocker arm, extract the lifter, and inspect for a defect or debris

50. An engine was rebuilt using all new components and machined to specification. On the first oil change at 500 miles, the technician tests the oil pressure: hot idle reads 28 PSI (specification minimum 20 PSI) and 2,500 RPM reads 52 PSI (specification 40–65 PSI). At the 5,000-mile service, the readings are 25 PSI at idle and 48 PSI at 2,500 RPM — both still within specification. At the 10,000-mile service, the readings are 24 PSI at idle and 47 PSI at 2,500 RPM. Which of the following BEST describes the trend?

A. The pressure decrease is accelerating and indicates a premature bearing or pump failure developing

B. The pressure trend is abnormal because pressure should increase slightly as rings seat and friction decreases

C. The pressure is stabilizing after initial break-in wear and the decreasing rate of change indicates normal aging

D. The oil pump relief valve is gradually weakening and needs to be replaced before pressure drops further

Practice Exam 10: 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 — The compression reading of 142 PSI is barely above the 140 PSI minimum, the wet test shows modest improvement (confirming minor ring wear), and the leak-down at 12% with faint air at the oil filler confirms slight ring bypass — but none of these readings indicate a severe failure. [A] The findings are borderline: the cylinder meets minimum specification individually, but the marginal ring seal may be just enough to cause an idle misfire where cylinder pressures are lowest. At higher RPM with increased cylinder pressure and ring seating force, the misfire likely disappears.

2. A — A brief puff of white vapor on cold start that disappears within 30 seconds, with stable coolant level and clean oil over three months, is normal water condensation in the exhaust system. [A] Overnight, moisture from ambient humidity and residual combustion water condenses on the cold interior surfaces of the exhaust pipes, muffler, and catalytic converter. On startup, the hot exhaust gases vaporize this condensation, producing visible white steam that exits the tailpipe until the exhaust system warms up and the moisture evaporates completely.

3. B — This vacuum gauge pattern — steady 20 in. Hg at idle, drop to near zero at wide-open throttle, overshoot to 24 in. Hg on deceleration, and return to 20 at idle — describes a perfectly normal, healthy engine. [A] The idle reading is within the normal 17–21 range. The WOT drop to near zero is expected because the open throttle eliminates the restriction that creates vacuum. The deceleration overshoot to 24 is normal because the closed throttle and engine braking create maximum vacuum. This is the textbook normal response pattern.

4. C — A vertical score 0.006 inches deep in a cylinder bore is far too deep to be removed by honing — honing removes only a few ten-thousandths of an inch per pass. [C] The bore must be bored to the next oversize that completely removes the scoring. On a 3.780-inch standard bore, boring to 3.790 (0.010 oversize) or 3.800 (0.020 oversize) should be sufficient to machine past a 0.006-inch deep score. A matching oversize piston is installed in the bored cylinder.

5. A — Both technicians are correct. [E] Technician A is right: on engines where both the alternator and water pump are driven by the same serpentine belt, a slipping belt simultaneously reduces alternator

charging output and water pump impeller speed, causing both undercharging and reduced coolant circulation from a single belt failure. Technician B is also right: excessive belt tension overloads the bearings of every accessory the belt drives, causing premature bearing failure in the water pump, alternator, and other components.

6. D — All findings converge on worn main bearings: a deep thump from the lower block that does not change with individual cylinder disable (main bearings support all cylinders), oil pressure below the minimum specification at idle (excessive bearing clearance lets oil escape faster than the pump can supply at low RPM), and improvement at higher RPM (increased pump output partially compensates for the leakage). [D] The below-spec idle pressure confirms the bearing clearances have exceeded their designed limits.

7. B — An idle surge that cycles every 20 seconds with no codes and normal compression is consistent with a small vacuum leak that the PCM's closed-loop fuel trim system is chasing. [A] The unmetered air entering through the leak leans the mixture, causing the PCM to add fuel. The correction overshoots slightly (RPM rises), the PCM then reduces fuel (RPM drops), and the cycle repeats. This oscillating compensation pattern produces the characteristic periodic surge at idle.

8. C — An interference engine that becomes noticeably harder to turn at one specific point during hand rotation after a timing chain installation means a valve is contacting a piston crown at that rotational position. [B] This indicates one of the camshaft sprockets is one tooth off from its correct timing mark — close enough that most of the rotation feels normal, but at the point of maximum valve overlap, the mistimed valve extends far enough to contact the piston. The timing must be corrected before the engine is started to prevent catastrophic valve damage.

9. A — Fuel pressure that reads 25 PSI at key-on (below the 55 PSI specification) but climbs to 55 PSI after the pump runs for three seconds confirms the fuel rail lost pressure overnight. [E] A properly functioning fuel system maintains near-specification pressure for hours after key-off. Pressure bleeding down overnight indicates either a leaking fuel pump check valve (allowing fuel to drain back to the tank) or a leaking fuel injector (allowing fuel to drip into a cylinder). The extended cranking time equals the time needed to repressurize the empty rail.

10. D — A crack between adjacent exhaust valve seats on an aluminum cylinder head — especially one visible without magnification and 1.5 inches long — represents a structural failure in the thinnest, highest-stress area of the head casting. [B] Aluminum head cracks in this location cannot be reliably repaired because the material between valve seats is too thin to hold a weld or pin repair under the extreme thermal cycling of exhaust port operation. The head must be replaced.

11. C — Compression readings of 170–175 PSI on an engine specified at 140–165 PSI maximum indicate the combustion chamber volume has been reduced below its designed dimensions. [A] The most common cause at 95,000 miles with no performance complaints is excessive carbon buildup on the piston crowns and combustion chamber surfaces that gradually reduces chamber volume and raises the effective compression ratio. This condition increases the risk of detonation on the recommended fuel grade.

12. B — A starter current draw of 95 amps — well below the 120–180 amp specification — with faster-than-normal cranking speed means the starter is encountering much less mechanical resistance than designed. [E] Low compression across multiple cylinders reduces the resistance each piston presents during its compression stroke. The starter spins the engine more easily, drawing less current and cranking faster. This finding supports a diagnosis of severely low compression — likely from a timing belt/chain failure, uniformly worn rings, or a similar condition affecting all cylinders.

13. D — Both heater hoses being equally hot at the firewall confirms that hot coolant is flowing through the heater core — the engine cooling system is delivering heat to the core correctly. [D] If the heater core had adequate hot coolant flowing through it but the cabin still received cold air, the problem is in the HVAC air distribution system, not the cooling system. A failed blend door actuator that cannot direct air across the hot heater core is the most common non-engine cause of this complaint.

14. A — Technician A only is correct: taper is measured by comparing journal diameters taken at two different positions along the journal's length in the same direction — the difference reveals how much the journal has worn unevenly from one end to the other. [C] Technician B describes out-of-round, not taper. Out-of-round is measured by comparing two perpendicular readings at the same axial location. The two measurements — taper and out-of-round — use different measurement orientations and should not be confused.

15. C — A new front crankshaft seal that leaks within 500 miles despite a clean snout surface, functional PCV, and correct installation tool should be investigated for depth and orientation accuracy. [D] Some front seals must be pressed to a very specific depth in the timing cover — too deep or too shallow changes the seal lip's contact point on the snout. Some seals are also directional — the spring-loaded lip must face the oil side. If the seal was pressed to an incorrect depth or installed backwards, it will leak despite appearing correctly seated.

16. D — A ticking noise heard through the stethoscope only when placed on the fuel rail — not on the valve cover, timing cover, or oil pan — is normal fuel injector clicking. [E] Fuel injectors are electrically actuated solenoid valves that open and close in rapid pulses, producing a distinct clicking

sound. The metal fuel rail conducts this sound efficiently, making it clearly audible through the stethoscope. This is normal operation, not a fault.

17. A — When a bore requires machining beyond the manufacturer's maximum recommended oversize, installing a cylinder sleeve preserves the original block. [C] The sleeve is a precision-machined cast iron or steel tube that is pressed into the bored-out cylinder, restoring it to standard bore diameter with a new, unworn surface. This allows standard-size pistons to be used and maintains the original block's identity — critical for the rare classic vehicle the customer wants to preserve.

18. B — On engines where the PCV system connects to the intake tract upstream of the turbocharger compressor inlet, normal PCV oil vapor enters the compressor along with fresh air. [A] The oil vapor passes through the compressor, is pressurized, and then enters the intercooler where it cools and condenses into liquid oil that accumulates in the intercooler piping. This is a known characteristic of this PCV routing design and is considered normal — not a turbo seal failure. Some vehicles have oil catch cans installed to capture this vapor before it reaches the compressor.

19. A — Both technicians are correct and are describing the same cause-and-effect chain. [E] Technician A is right: a cracked exhaust manifold upstream of the oxygen sensor allows ambient air to be drawn into the exhaust stream during low-pressure exhaust pulses, and the extra oxygen reaching the O2 sensor creates a false lean reading. Technician B correctly identifies the consequence: the PCM reads the false lean signal and responds by enriching the fuel mixture to compensate for a lean condition that does not actually exist in the combustion chambers.

20. B — Uniformly low compression across all six cylinders (100–110 versus 145–165 specification), a steady low vacuum reading (14 in. Hg versus normal 17–21), and a wet test that improves all cylinders by 15–20 PSI together confirm generalized ring and bore wear throughout the engine. [A] The wet test improvement proves the rings are the primary source of compression loss. The uniform distribution confirms no single cylinder failure — the entire engine is worn. The low vacuum reading correlates directly with the reduced compression across all cylinders.

21. B — The two plugs tell two completely different stories about their respective cylinders. [A] Cylinder 5's oil-fouled plug (wet black deposits) indicates engine oil is entering that combustion chamber — from worn rings, valve guides, or valve stem seals. Cylinder 6's steam-cleaned white plug with crystalline deposits indicates coolant is entering that combustion chamber — from a head gasket breach, cracked head, or cracked block. These are two independent conditions that may or may not share a common root cause.

22. A — A decreasing quantity of metallic particles in successive oil filter inspections — from the initial break-in amount at 500 miles to a lesser amount at 10,000 miles — indicates the wear-in process is progressing normally and decelerating. [D] New bearings, rings, and other mating surfaces generate the most wear particles during initial break-in as they conform to each other. As surfaces burnish and stabilize, the particle generation rate decreases. Declining particle counts with normal oil pressure and no noise confirm a healthy engine.

23. C — The fan motor spins normally when powered directly, confirming the motor itself is functional. [D] The engine overheats at low speed (where the fan is needed) but cools at highway speed (where ram air compensates) — confirming the fan is not activating when the engine needs it. Since the motor works, the failure is in the activation circuit: the coolant temperature sensor may not be triggering the relay, the relay may have failed, or the wiring between the temperature sensor, relay, and fan motor may have an open circuit.

24. D — Coolant standing in a head bolt hole that does not intersect any coolant passage according to manufacturer specifications indicates an abnormal pathway for coolant to reach that location. [C] The most likely cause is a crack in the block between a nearby coolant passage and the bolt hole, allowing pressurized coolant to migrate through the crack. This finding must be investigated with dye penetrant testing before proceeding — installing a head gasket over a cracked bolt hole leads to ongoing coolant loss and potential repeat failure.

25. B — VVT system malfunctions caused by sludge contamination from extended oil change intervals with incorrect oil are best addressed by first correcting the contamination source and replacing the most commonly affected component. [B] The VVT oil control valve (solenoid) has a fine-mesh screen that clogs with sludge, and replacing it with a fresh valve restores proper oil flow to the cam phaser. Changing the oil and filter with the manufacturer-specified full synthetic removes the contaminated oil. This is the most cost-effective first step before considering more expensive phaser or chain replacement.

26. A — Technician A only is correct: connecting rod big-end bore diameter must be measured with the cap installed and torqued to specification because the bore's final shape and size are determined by the combined assembly of the rod and cap under their designed clamping force. [C] Measuring the bore with the cap removed gives an incomplete and inaccurate picture because the bore dimensions change when the cap is torqued into place. The torqued assembly is the actual operating condition and is the only valid measurement state.

27. C — A 10 PSI drop in oil pressure (60 to 50 PSI) during the first 500 miles of a rebuild with verified clearances, correct oil, and no abnormal noise is normal break-in wear. [D] New bearing surfaces undergo a controlled wear-in process where the soft overlay material conforms to the journal, and ring

surfaces seat against the honed bore. This micro-wear process slightly increases clearances from their as-assembled dimensions, allowing marginally more oil flow and producing a measurable — but normal and expected — decrease in system pressure.

28. D — Cylinder 7 consistently fouling with dry black carbon deposits while all other plugs are normal, combined with confirmed 10% over-delivery from the cylinder 7 fuel injector, directly identifies the rich fuel condition on that specific cylinder. [E] The excess fuel creates a chronically rich mixture in cylinder 7 that cannot be fully combusted, leaving dry carbon deposits on the plug. The fact that the deposits are dry carbon (not wet oil or crystalline coolant) confirms fuel over-delivery rather than oil or coolant contamination. The injector should be replaced or professionally cleaned.

29. C — A freeze plug bore with moderate pitting from corrosion creates an uneven sealing surface that a standard press-fit plug may not seal against reliably. [C] Applying a sealing compound (such as Permatex Aviation Form-A-Gasket or a similar non-hardening sealant) to the plug perimeter fills the minor pitting voids and creates a reliable seal despite the imperfect bore surface. This is a standard repair practice for mildly corroded plug bores that are still within the standard diameter range.

30. B — Compression readings that are below specification when cold (130–138 PSI) but within specification when hot (148–155 PSI) demonstrate the effect of thermal expansion on ring and bore sealing. [A] When cold, the aluminum pistons and cast iron bore have not yet expanded to their operating dimensions — the wider clearances at cold temperature allow more blowby past the rings, reducing compression. As the engine warms and components expand, the clearances tighten, the rings seal more effectively, and compression rises to within specification.

31. A — Both technicians are correct. [C] Technician A is right: after resizing the big end of a connecting rod, the center-to-center distance (from the small-end pin bore center to the big-end bore center) must be verified. Technician B correctly explains why: the resizing process involves machining a small amount of material from the cap mating surfaces before re-boring the big end to specification, and this material removal shortens the overall rod length. If too much material is removed, the rod becomes too short and piston deck height is affected.

32. D — Two adjacent cylinders (1 and 2) with very low compression (40 PSI) while cylinders 3 and 4 are normal, on an interference engine at 50,000 miles since the last timing belt service, points to the timing belt jumping teeth on the camshaft sprocket. [A] When the belt jumps on an interference engine, the mistimed valves extend into the piston path, and the pistons bend the valves on the affected cylinders. The bent valves cannot close, producing catastrophically low compression. Cylinders 3 and 4 may have been spared if the belt jumped only enough teeth to affect the timing of the first two cylinders' valve events.

33. B — Murky brown coolant with visible particles after two years of service — within the correct maintenance interval — suggests either the coolant additive package has depleted and internal corrosion has begun, or incompatible coolant types were mixed at some point during the vehicle's service history. [D] When corrosion inhibitors deplete, the coolant becomes acidic and attacks internal metal surfaces (aluminum, iron, copper, solder), producing the brown discoloration and particulate contamination. A complete flush and refill with the manufacturer-specified coolant type is required.

34. C — Taper is the difference between the largest and smallest measurements taken in the same direction at different heights: perpendicular readings are 3.7820 (top) minus 3.7808 (bottom) = 0.0012 inches; parallel readings are 3.7815 (top) minus 3.7806 (bottom) = 0.0009 inches. Maximum taper is 0.0012 inches (the larger value). [C] Out-of-round is the difference between perpendicular measurements at the same height: at the top, 3.7820 minus 3.7815 = 0.0005 inches; at the bottom, 3.7808 minus 3.7806 = 0.0002 inches. Maximum out-of-round is 0.0005 inches. The taper of 0.0012 is the larger concern and must be compared to the manufacturer's specification.

35. A — A vehicle that has difficulty starting only when parked on a steep uphill grade, with all systems testing normal on level ground, points to the fuel supply being affected by vehicle inclination. [E] When parked steeply uphill, the fuel in the tank shifts toward the rear, and if the fuel level is low enough, the tank-mounted fuel pump pickup may be partially uncovered. The pump draws air mixed with fuel, reducing delivery pressure and volume during cranking. On level ground, the fuel covers the pickup normally and the problem disappears.

36. B — An oil level rising above the full mark without oil being added, with no fuel smell and normal oil appearance, indicates another fluid is entering the crankcase. [D] On a vehicle with a liquid-cooled engine oil cooler, a ruptured internal barrier allows coolant to cross into the oil under the cooling system's higher operating pressure. In the early stages, the coolant volume may be small enough that the oil does not appear milky — it simply raises the level. Checking for a corresponding coolant level drop and inspecting the oil for emulsification at the filler cap confirms the diagnosis.

37. D — Oil drain-back holes in the cylinder head allow oil that has lubricated the valvetrain to return to the oil pan by gravity. [D] When these holes are clogged with sludge, oil accumulates in the valve cover area and pools around the valve stems and guides. The increased oil volume around the valve stems provides more oil available to leak past the valve stem seals into the intake and exhaust ports, where it is drawn into the combustion chamber and burned. Clearing the drain-back holes restores normal oil drainage and reduces the oil available to leak past the seals.

38. A — Both technicians are correct. [D] Technician A is right: filling the cooling system slowly reduces turbulence and allows air to escape naturally through the highest points of the system rather than

being trapped in pockets. Technician B is also right: many modern engines have dedicated bleeder screws or valves at high points in the cooling circuit (often at the thermostat housing or heater hose connection) specifically designed to purge trapped air during filling.

39. C — The scan tool data shows negative fuel trim of minus 12% during hard acceleration — meaning the PCM is reducing fuel delivery by 12% because the mixture is running rich. [E] The sulfur (rotten egg) smell is produced when the catalytic converter processes a rich exhaust mixture. Gasoline contains sulfur compounds, and under rich conditions, the converter produces hydrogen sulfide gas — the source of the sulfur smell. The rich condition during hard acceleration is the root cause, and the sulfur smell is the secondary symptom of the converter processing the excess fuel.

40. D — Conventional (non-TTY) connecting rod bolts are designed to operate within their elastic limit and return to their original dimensions when removed. [C] If the bolt lengths measure within 0.001 inches of the new-bolt specification and the threads show no damage, the bolts have not been permanently stretched and can be safely reused. This is a key distinction from TTY bolts, which are permanently stretched during installation and must always be replaced. The dimensional verification confirms these conventional bolts are within their design limits.

41. A — The valve cover gasket seeping at one corner is the confirmed source of the external oil drip and should be replaced. [A] The oil consumption of one quart per 3,000 miles at 160,000 miles, with no other symptoms, falls within or near the acceptable range for many manufacturers and does not warrant top-end engine work. Replacing the leaking gasket addresses the customer's visible complaint without recommending unnecessary additional work for a consumption rate that is age-appropriate.

42. B — A vacuum reading that starts normal at sustained RPM but gradually decreases over a 30-second period — then immediately recovers when RPM is dropped to idle — is the classic diagnostic pattern of a restricted exhaust system. [A] At idle, the low exhaust flow volume can pass through the restriction. At sustained 2,000 RPM, the higher exhaust volume gradually accumulates behind the restriction faster than it can pass through, building back-pressure that progressively reduces intake vacuum. Returning to idle immediately reduces exhaust volume, the back-pressure bleeds off, and vacuum recovers.

43. D — A single clunk from the rear of the engine that occurs only when the transmission engagement direction changes (Park to Drive, or Drive to Reverse) and does not repeat during driving points to excessive crankshaft end play. [A] When the transmission engages, the torque converter applies an axial load to the crankshaft through the flexplate. If the thrust bearing is worn and end play is excessive, the crankshaft shifts noticeably in one direction, producing a single clunk. The noise does not repeat because the crankshaft stays pushed against one thrust surface during sustained driving in a single gear.

44. A — The radiator cap's pressure relief function is working correctly (releases at 16 PSI), but the vacuum valve is stuck closed. [D] When the engine cools and coolant contracts, the vacuum valve should open to allow coolant to be drawn back from the overflow tank into the radiator. With the vacuum valve stuck closed, coolant cannot return, and the resulting vacuum inside the cooling system can collapse the most flexible component — typically the upper radiator hose. Each heat cycle pushes coolant to the overflow but cannot draw it back, resulting in progressive coolant loss.

45. D — Air leaking simultaneously from the intake manifold opening (intake valve not sealing) and the oil filler cap (rings not sealing) on the same cylinder with 50% leakage and very low compression indicates two independent component failures on cylinder 4. [A] The wet test showing minimal improvement (60 to 65 PSI) confirms the rings alone are not the sole problem — if they were, the wet test would show significant improvement. The simultaneous presence of intake valve leakage and ring blowby on the same cylinder is uncommon but does occur, particularly on high-mileage engines with generalized wear.

46. C — Both technicians are correct. [A] Technician A is right: the ignition system must be disabled to prevent the engine from starting during compression testing — the test requires cranking without combustion. Technician B is also right: the fuel system must be disabled to prevent raw fuel from being injected into the cylinders during cranking, which creates a fire hazard, fouls the spark plugs, and washes lubricating oil from the cylinder walls.

47. A — A P0171 lean code that appeared immediately after installing an aftermarket air intake, with normal mechanical tests, points to unmetered air entering the intake tract downstream of the mass airflow sensor. [E] The MAF sensor measures the air entering through the filter, and the PCM bases its fuel calculations on this measurement. If air enters past the sensor through a poorly sealed filter housing, a loose clamp, or a gap in the intake tube, that air is not measured by the MAF and no corresponding fuel is added — creating a lean condition that triggers the code.

48. B — A grayish-white exhaust tint that is more visible in cold weather, with stable coolant level, clean oil, a negative block test, and 200,000 miles of service is normal water vapor condensation. [E] Combustion of hydrocarbon fuel produces water as a byproduct. This water vapor exits the tailpipe as part of normal exhaust. In cold ambient temperatures, the vapor condenses and becomes visible as a grayish-white plume — the same principle as seeing your breath on a cold day. This is a normal physical phenomenon, not an indication of engine malfunction.

49. D — A hydraulic lifter that begins ticking 30 seconds into a first start on a pre-lubricated rebuilt engine and continues ticking for five minutes without resolving is not exhibiting normal fill-up behavior. [B] Normal lifter fill-up on a pre-lubricated engine resolves within 30 to 60 seconds. A persistent tick

after five minutes suggests the lifter has a defect — a damaged check valve, debris under the check ball, a scored plunger bore, or a manufacturing defect — that prevents it from maintaining its oil charge. The lifter should be removed and inspected rather than hoping it will resolve with continued running.

50. C — The oil pressure readings show a decreasing trend that is decelerating: a 3 PSI drop in the first 5,000 miles (28 to 25), then only 1 PSI in the next 5,000 miles (25 to 24). [D] This decelerating rate of change indicates the initial break-in wear is tapering off and bearing clearances are stabilizing at their post-break-in dimensions. All readings remain within specification. This is the normal pressure trajectory of a rebuilt engine — rapid initial decrease during active break-in followed by stabilization as surfaces reach their equilibrium wear state.