PRACTICE EXAM 20: ASE A1 ENGINE REPAIR SIMULATION (50 QUESTIONS)

1. A technician is diagnosing a V8 engine with an intermittent rough idle that occurs unpredictably — sometimes for 10 seconds, sometimes for several minutes — and then resolves on its own. No codes are stored. Compression is within specification on all eight cylinders. Fuel trims are within plus or minus 4% on both banks during normal idle. During the rough episodes, the technician captures scan data showing bank 1 long-term fuel trim spiking to plus 16% while bank 2 remains at plus 3%. Between episodes, bank 1 returns to plus 3%. Which of the following is the MOST likely cause?

A. A failing fuel pump that intermittently drops pressure below the injectors' minimum operating threshold

B. An intermittent vacuum leak on bank 1 that opens and closes unpredictably, introducing unmetered air only during the rough episodes

C. A failing bank 1 oxygen sensor that intermittently reads falsely lean and causes the PCM to over-enrich

D. An intermittent ignition coil failure on one bank 1 cylinder that the PCM compensates for with fuel trim

2. A rebuilt engine has been running flawlessly for 25,000 miles. The customer brings the vehicle in for a routine service. The technician tests oil pressure: 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. At the 500-mile break-in service, readings were 30 PSI idle and 56 PSI at speed. At the 10,000-mile service, readings were 22 PSI idle and 46 PSI at speed. Which of the following BEST characterizes this engine's pressure trend over 25,000 miles?

A. The pressure decline is accelerating and indicates premature bearing failure requiring immediate attention

B. The oil pump is failing and should be replaced before the speed pressure drops below specification

C. The pressure trend is abnormal because the idle reading should have stabilized higher than 18 PSI by now

D. The rate of pressure decrease has decelerated over time and all readings remain at or above specification — the engine has reached its post-break-in equilibrium and the pressure will stabilize near these values

3. A four-cylinder engine with a DOHC timing chain system develops codes P0016 (cam/crank correlation bank 1) and P0017 (cam/crank correlation bank 1 sensor B — exhaust). The engine has 115,000 miles with oil changes every 5,000 miles using the specified full synthetic. The engine idles roughly and has noticeably reduced low-speed torque. A timing chain measurement shows 4 degrees of retardation on the intake cam and 6 degrees on the exhaust cam — both beyond specification. Which of the following BEST explains why the exhaust cam shows more retardation than the intake?

A. The timing chain drives the intake cam directly and the exhaust cam is driven from the intake cam through an intermediate chain or gear — the additional link in the drive train amplifies the chain stretch effect on the exhaust side

B. The exhaust cam retardation is caused by a VVT phaser failure rather than chain stretch and is independent of the intake cam deviation

C. The exhaust cam sprocket has a manufacturing defect that allowed it to slip independently of the chain

D. Both cams should show identical retardation from chain stretch and the different readings indicate the measurement was performed incorrectly

4. A customer reports that the engine produces a rhythmic ticking noise from the valvetrain area that has been present for 60,000 miles without any change in character, volume, or frequency. Oil level is always maintained. Oil pressure is within specification at all conditions. Compression is within specification on all cylinders. The customer asks whether this long-standing tick indicates a problem that will lead to engine failure. Which of the following is the MOST accurate response?

A. The tick will inevitably worsen and lead to cam lobe failure within the next 20,000 miles

B. Any ticking noise from the valvetrain indicates a developing problem that requires immediate disassembly

C. A stable, unchanging tick present for 60,000 miles with normal oil pressure and compression is most likely a minor valvetrain characteristic that has not progressed and does not indicate impending failure — monitoring at each service is appropriate

D. The tick is from a worn timing chain that will eventually jump and cause catastrophic engine damage

5. A technician performs a comprehensive diagnostic on an engine with 240,000 miles: compression is 108 to 118 PSI on all six cylinders (specification 145 to 170), wet test improves all by 20 to 28 PSI, vacuum is a steady 12 in. Hg at sea level, oil pressure is 10 PSI at hot idle (specification minimum 10) and 30 PSI at 2,500 RPM (specification 40 to 65), oil consumption is one quart per 800 miles, and a faint rod knock is audible on cylinder 5 that diminishes when the injector is disabled. The customer asks for a straightforward assessment. Which of the following is the MOST honest and accurate response?

A. The engine is at the end of its useful service life — compression is uniformly below specification from severe ring wear, oil pressure is at minimum at idle and below specification at speed, a rod bearing is failing on cylinder 5, and the cumulative wear across all systems means the engine will continue to decline and is at elevated risk of sudden bearing failure

B. The engine is in acceptable condition for its mileage and will likely last another 50,000 miles with regular maintenance

C. Only the cylinder 5 rod bearing needs repair and the rest of the engine is within acceptable parameters

D. The engine should be scrapped immediately because it is unsafe to drive in its current condition

6. A technician is rebuilding an engine that had a catastrophic rod bearing failure on cylinder 2. During disassembly, the technician finds metallic debris in the oil filter, on the oil pickup screen, and embedded in the soft bearing material of the number 3 main bearing — two positions away from the failed rod. Which of the following does this debris distribution confirm about the failure?

A. The number 3 main bearing failed first and sent debris to the number 2 rod bearing, causing the secondary failure

B. The metallic debris was already present before the failure and was the original cause of the rod bearing damage

C. The debris was confined to the number 2 rod area and could not have reached the number 3 main bearing

D. The debris from the number 2 rod bearing failure circulated through the entire oil system, damaging downstream components including the number 3 main bearing — confirming that every bearing surface must be inspected and every oil gallery flushed before reassembly

7. A vehicle with a turbocharged engine develops a P0299 (underboost) code. Maximum boost reaches only 12 PSI instead of the specified 20 PSI. The wastegate actuator rod moves freely. A boost leak test using shop air reveals no leaks in the charge air piping. The air filter is clean. The turbocharger shaft has

no measurable play. The exhaust system has no leaks or restrictions. Which of the following should the technician check NEXT?

A. The intercooler for an internal restriction that is throttling the compressed air before it reaches the intake

B. The wastegate valve itself for carbon buildup that holds it partially open despite the actuator rod moving freely

C. The compressor wheel for blade damage that reduces its pumping efficiency at higher rotational speeds

D. The boost pressure sensor for a calibration drift that is reporting higher boost than actual to the PCM

8. A customer brings in a vehicle after the engine suddenly lost all power while driving at highway speed. The engine stopped running completely. The engine will not crank — the starter solenoid clicks but the crankshaft does not rotate. The battery is fully charged and the starter current draw exceeds 400 amps. The engine was running perfectly before the sudden failure. Which of the following is the MOST likely cause?

A. The starter motor has failed and cannot produce torque despite drawing maximum current from the battery

B. A corroded battery cable is limiting current delivery to the starter motor and preventing rotation

C. The engine has seized internally — the starter cannot rotate the crankshaft against the mechanical resistance of a catastrophic internal failure such as a thrown rod, seized bearing, or hydrostatic lock

D. The flywheel ring gear has stripped and the starter pinion cannot engage any teeth to rotate the crankshaft

9. A technician is performing the final quality check on a rebuilt engine. The engine has been through three complete heat cycles. Compression is within specification on all cylinders. Oil pressure is within specification. A block test is negative. The technician performs a relative compression test with a starter current clamp — all eight cylinders produce nearly identical current spikes within 5% of each other. Which of the following does the uniform relative compression pattern confirm about the rebuild quality?

A. All eight cylinders have equivalent sealing ability and no single cylinder is significantly weaker than the others — confirming uniform ring seating, valve sealing, and gasket integrity across the entire engine

B. The starter motor is functioning correctly and producing uniform cranking speed for all cylinders

C. The battery is fully charged and delivering consistent voltage throughout the cranking test sequence

D. The oil pump is distributing equal oil pressure to all cylinders during the cranking operation

10. A rebuilt engine develops a very faint blue haze from the exhaust visible only in direct sunlight against a white background. The haze is present at idle and during light acceleration. Oil consumption is approximately one quart per 2,000 miles. The engine has 3,000 miles since the rebuild. Compression is within specification on all four cylinders and is actually 5 to 8 PSI higher than pre-rebuild readings. Oil pressure is within specification. The PCV system is functional. Which of the following is the MOST likely cause at 3,000 miles post-rebuild?

A. The valve stem seals were not replaced during the rebuild and are leaking oil past the valve guides

B. The oil pump is producing excessive pressure that is forcing oil past the piston ring end gaps

C. The piston rings have not yet fully seated against the freshly honed bore surface and are allowing a small amount of oil past during break-in — the higher-than-original compression confirms the bore and rings are mechanically correct and the consumption should decrease as seating completes

D. The crosshatch angle was cut at an incorrect specification that prevents proper oil retention in the bore

11. A V6 engine has the following leak-down results: Cyl 1 = 6%, Cyl 2 = 8%, Cyl 3 = 5%, Cyl 4 = 7%, Cyl 5 = 32%, Cyl 6 = 6%. Cylinder 5 has air audible at the adjacent cylinder 4's spark plug hole — not at the tailpipe, intake, oil filler, or coolant. Compression on cylinder 5 is 85 PSI while cylinder 4 is 112 PSI. All other cylinders are between 148 and 158 PSI. Which of the following is the MOST likely cause?

A. A cracked cylinder head between the combustion chambers of cylinders 4 and 5 that allows compression to cross-leak

B. Both cylinders have severely worn piston rings that allow compression to cross-communicate through the crankcase

C. The intake manifold gasket has failed between the two intake ports for cylinders 4 and 5

D. A head gasket failure between the combustion chambers of cylinders 4 and 5 that allows compression from each cylinder to leak into the other during their respective compression strokes

12. A technician is diagnosing an engine with a persistent P0420 (catalyst efficiency below threshold) code on a vehicle with 60,000 miles. The engine has no misfires, no oil consumption, and normal fuel trims. The upstream O2 sensor switches normally. The downstream sensor shows switching activity that mirrors the upstream sensor. The catalytic converter was replaced with an aftermarket unit 5,000 miles ago. Which of the following is the MOST likely cause of the recurring code?

A. The upstream oxygen sensor is contaminated and providing false data that the PCM interprets as converter inefficiency

B. The aftermarket catalytic converter does not contain sufficient catalyst material to meet the OEM conversion efficiency threshold for this vehicle's emissions monitoring calibration

C. The downstream oxygen sensor has failed and is producing false switching signals that mimic converter inefficiency

D. The exhaust system has a leak between the converter and the downstream sensor that introduces ambient oxygen

13. A customer reports that the engine has been gradually losing power over six months. Compression is uniformly low at 120 to 128 PSI on all four cylinders (specification 145 to 160). A vacuum gauge reads 14 in. Hg at idle. A timing chain measurement shows 5 degrees of camshaft retardation. A wet test improves all cylinders by only 6 to 9 PSI. Which of the following BEST explains the comprehensive diagnostic picture?

A. The ring wear is the primary cause and the timing chain stretch is a coincidental secondary finding

B. The timing chain stretch alone is responsible for the low compression, low vacuum, and power loss

C. The timing chain stretch is the primary cause of the low compression — the retarded cam timing closes the intake valve late, reducing effective compression — and the minimal wet test improvement confirms that rings are not the primary leak source because oil cannot seal a valve timing problem

D. The vacuum leak from a cracked intake manifold is the primary cause of all findings

14. Technician A says that a rebuilt engine should have its first oil change at 500 miles to remove break-in contaminants. Technician B says that after the 500-mile change, the second oil change should occur at 3,000 to 5,000 miles — not the manufacturer's extended interval — to continue removing residual break-in particles that the first change did not fully capture. 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

15. A vehicle owner reports that the engine oil turns black within 300 miles of every oil change. The engine has 170,000 miles but runs normally with no misfires, codes, or performance complaints. Oil analysis shows normal wear metals, no coolant contamination, and no fuel dilution. The only abnormal finding is elevated soot content. Which of the following is the MOST likely cause?

A. The oil filter is an incorrect application that is not filtering soot from the circulating oil effectively

B. The engine's fuel injectors are clogged and producing an excessively rich mixture that generates more soot

C. The oil brand has weak dispersant additives that cannot keep soot in suspension and allow it to deposit on surfaces

D. Worn piston rings are allowing excessive blowby that forces a higher-than-normal volume of combustion soot past the rings into the crankcase oil, darkening it rapidly

16. A technician discovers during an engine rebuild that the block deck surface has a 0.003-inch depression in a localized area approximately the size of a quarter near the number 2 cylinder bore. The rest of the deck is flat within 0.001 inches. The depression is smooth — not a scratch or gouge. Which of the following is the MOST appropriate repair?

A. Fill the depression with metallic epoxy and sand flush because it is too small to warrant full resurfacing

B. Resurface the entire block deck to remove the depression and restore a uniform flat surface across the entire deck

C. Install a thicker head gasket to compensate for the localized depression at the number 2 bore area

D. The depression is within acceptable tolerance for modern MLS head gaskets and no repair is needed

17. A rebuilt engine produces a brief puff of white vapor from the exhaust every morning on the first cold start. The vapor disappears within 15 seconds and does not return during driving. The coolant level has remained stable for four months. The oil is clean. A block test is negative. The engine has 8,000 miles since the rebuild. Which of the following is the MOST likely cause?

A. A very minor head gasket breach that leaks only when the engine is fully cold and the gasket is contracted

B. A crack in the cylinder head that opens only at the thermal state of cold start and closes when warm

C. Normal condensation in the exhaust system that has accumulated overnight and vaporizes on the first start as the exhaust pipes heat up

D. A worn valve stem seal that allows coolant to pool on a valve face overnight and burn on startup

18. A technician is performing a cooling system inspection on a vehicle with an intermittent overheating complaint. The system holds pressure. A block test is negative. The thermostat opens at the correct temperature. The cooling fan activates at the correct temperature. The coolant level is correct. The technician measures the temperature differential between the radiator inlet and outlet with an infrared thermometer: inlet = 210°F, outlet = 170°F — a 40°F differential. The expected differential is 15 to 25°F. Which of the following does the excessive differential indicate?

A. A partially restricted radiator core that reduces coolant flow — the reduced volume of coolant passing through the core has extended contact time with the cooling tubes and loses more heat per unit volume, producing an excessively cool outlet temperature relative to the inlet

B. A water pump with a failing impeller that is circulating coolant faster than the radiator can cool it

C. An overly efficient radiator that is removing more heat than necessary and overcooling the outlet coolant

D. A thermostat that is opening too wide and allowing too much coolant to reach the radiator at once

19. A customer brings in a vehicle with an engine that cranks normally but takes approximately 8 seconds of cranking to start every cold morning. Once started, the engine runs perfectly and restarts immediately throughout the day. Fuel pressure at key-on reads 15 PSI — far below the 55 PSI specification. After the fuel pump runs for 5 seconds, pressure reaches 55 PSI and the engine starts. A warm restart shows pressure at 48 PSI at key-on. Which of the following is the MOST likely cause of the cold-morning extended crank?

A. A weak fuel pump that takes 5 seconds to reach full pressure output on cold mornings due to cold motor windings

B. The starter motor draws excessive current on cold mornings, reducing voltage to the fuel pump circuit

C. A failing coolant temperature sensor that underreports the engine temperature, delaying cold-start enrichment

D. A leaking fuel pump check valve or fuel injector that allows fuel pressure to bleed down overnight — the 15 PSI residual confirms significant pressure loss, and the warm-restart reading of 48 PSI shows pressure holds better over shorter sitting periods

20. Technician A says that the most comprehensive single test to verify a rebuilt engine's quality before customer delivery is a thorough road test under varied conditions — cold start, warm-up, idle, cruise, full acceleration, deceleration, and hill climbing. Technician B says that a complete leak-down test on all cylinders is the most comprehensive single post-rebuild verification. Who is correct?

A. Technician A only

B. Technician A is correct because a road test exercises every engine system under real-world operating conditions simultaneously — cold start tests enrichment and lifter fill, warm-up tests the thermostat and cooling progression, idle tests base compression and oil pressure, cruise tests sustained operation, acceleration tests maximum cylinder pressure, deceleration tests valve sealing under high vacuum, and hill climbing tests maximum sustained load — no single bench test replicates this complete spectrum

C. Technician B only

D. Both Technician A and Technician B

21. A V8 engine with 200,000 miles exhibits oil pressure of 12 PSI at hot idle (specification minimum 10 PSI) and 32 PSI at 2,500 RPM (specification 40 to 65 PSI). The engine has no knocking. Compression is uniformly low at 120 to 130 PSI (specification 145 to 170). Oil consumption is one quart every 1,500 miles. The customer drives the vehicle 5,000 miles per year and wants to continue using it for basic transportation. Which of the following recommendations BEST serves this customer's needs?

A. Shorten the oil change interval to 3,000 miles, use the manufacturer-specified viscosity, monitor oil pressure at each service, and advise the customer that the engine is below specification at speed but has not yet reached catastrophic failure — with careful maintenance and gentle driving, the engine may continue functioning for the customer's limited annual mileage, though the risk of bearing failure increases with each mile

B. Rebuild the engine immediately because both compression and speed oil pressure are below specification

C. Switch to a heavier viscosity oil to raise the oil pressure readings into specification at both idle and speed

D. Replace the engine with a remanufactured unit because rebuilding a 200,000-mile engine is not cost-effective

22. A freshly rebuilt engine is started for the first time. Oil pressure reaches 55 PSI within 2 seconds. All four exhaust ports produce strong, even pulses. After 3 minutes of running at 1,500 RPM, the technician checks the oil level — it has dropped from the full mark to one quart below full. There are no visible external leaks on the floor or engine surfaces. The exhaust shows no visible smoke. Which of the following is the MOST likely explanation?

A. The oil pump is consuming oil internally through worn clearances and dumping it back to the pan without registering on the dipstick

B. One quart of oil is still filling the oil filter, oil cooler, and oil galleries that were empty at the moment of first start — the oil has redistributed from the pan to fill the entire pressurized oil system

C. The oil is being consumed through the rings at an extreme rate that will require immediate engine teardown

D. A rear main seal failure has occurred and oil is being thrown onto the bellhousing interior where it is not visible

23. A technician is measuring the connecting rod bearing clearance on a rebuilt engine using Plastigage. After torquing the rod cap to specification on the number 2 rod and carefully removing it, the Plastigage strip shows a uniform width at the center of the journal but tapers to a narrower width at both edges. Which of the following does this pattern indicate?

A. The connecting rod bore is out-of-round and the bearing is not conforming to the journal uniformly

B. The crankshaft rod journal is barrel-shaped — larger at the center and smaller at the edges

C. The Plastigage was placed too close to the edge of the bearing and the results are invalid

D. The crankshaft rod journal has an hourglass profile — smaller at the center than at the edges — indicating the center has worn more than the ends from the concentrated loading of the connecting rod's bending force

24. An engine block is being prepared for a rebuild. The technician hot-tanks the block, installs all plugs, and pressure-tests the oil galleries. Air is heard escaping from the number 3 cylinder bore. A dye penetrant test on the bore surface reveals a hairline crack between the oil gallery and the bore wall. The crack is approximately 1 inch long. Which of the following is the correct action?

A. Bore the cylinder to the next oversize to machine below the crack depth and eliminate the leak path

B. Replace the engine block because a crack between the oil gallery and a cylinder bore cannot be reliably repaired and will allow pressurized oil to enter the combustion chamber during operation

C. Install a cylinder sleeve to bridge the crack and seal the bore from the oil gallery passage

D. Apply a high-temperature metallic epoxy to the crack from inside the bore and then hone the surface smooth

25. A customer reports that the engine has developed an intermittent stalling condition that occurs only when the vehicle is idling at a complete stop with the A/C running, the automatic transmission in Drive, and the headlights on. The engine does not stall with any single accessory on individually. Compression is within specification. Oil pressure is within specification. Which of the following is the MOST likely cause?

A. The combined electrical and mechanical loads of the A/C compressor, torque converter in Drive, headlight alternator demand, and the base idle airflow exceed the engine's idle reserve capacity — the idle control system cannot maintain sufficient RPM under the simultaneous loading of all accessories

B. A failing fuel pump that drops pressure below the injectors' minimum operating threshold under the combined electrical load of all accessories

C. A worn camshaft that cannot produce sufficient valve lift to maintain idle under the parasitic loading

D. An exhaust restriction that produces sufficient back-pressure to stall the engine only under maximum accessory loading

26. A technician is performing a valve job on a DOHC cylinder head. After cutting all seats and lapping all valves, the technician performs a vacuum retention test on each port. All sixteen valves hold vacuum for over 60 seconds except the number 4 exhaust valve, which drops from 20 to 10 in. Hg in 20 seconds. The technician relaps the valve with additional compound and retests — the result improves to a 3 in. Hg drop in 60 seconds. Which of the following is the correct interpretation?

A. The 3 in. Hg drop in 60 seconds is still a failing result and the seat must be recut before the head is installed

B. The initial poor result was from a minor lapping imperfection that was corrected by additional lapping

C. The valve face has a defect that cannot be corrected by lapping and the valve must be replaced

D. The improved result of 3 in. Hg drop in 60 seconds represents an acceptable seal — a minor amount of leakage past a newly lapped seat is within normal tolerance and the valve will seat further during initial engine operation

27. A rebuilt engine is being broken in. The technician monitors the exhaust color during the first 30 minutes of operation. For the first 5 minutes, a faint blue-white haze is visible. From 5 to 15 minutes, the haze diminishes progressively. By 20 minutes, the exhaust is clear. The oil level has dropped from the full mark to approximately half a quart below full during the 30-minute run. Which of the following BEST describes this break-in behavior?

A. The blue-white haze indicates a valve stem seal defect that coincidentally resolved as the seals warmed

B. The diminishing haze and half-quart oil drop are caused by a PCV valve malfunction that corrected itself

C. The initial haze was from residual assembly lubricant and oil that entered the combustion chambers during assembly burning off, combined with rings that have not yet fully seated — the diminishing smoke and stabilizing oil level indicate normal break-in progression

D. The oil consumption rate of half a quart in 30 minutes projects to catastrophic consumption and indicates a ring installation error

28. A four-cylinder engine with 150,000 miles has the following diagnostic results: compression Cyl 1 = 142, Cyl 2 = 145, Cyl 3 = 140, Cyl 4 = 138 PSI. The specification is 140 to 160 PSI. All cylinders pass the minimum. The vacuum gauge reads 17 in. Hg at idle — within normal range. Oil pressure is 20 PSI at hot idle (specification minimum 15) and 44 PSI at 2,500 RPM (specification 40 to 65). The engine has no noise complaints, no misfires, and uses one quart of oil every 3,000 miles. The customer asks whether the engine needs any repair. Which of the following is the MOST appropriate response?

A. The engine needs immediate rebuilding because all compression readings are in the lower portion of the specification

B. The engine is in acceptable condition — all measured parameters are within specification, the oil consumption is within or near the manufacturer's acceptable range, and no repair is indicated at this time

C. The lower-range compression readings indicate the engine will fail within 10,000 miles

D. The valve stem seals should be replaced preemptively because the oil consumption rate suggests they are beginning to fail

29. A technician is performing the final inspection on a rebuilt engine before first start. The oil system has been pre-primed to 45 PSI. All rocker arms show oil flow. All piston cooling jets spray. The technician rotates the engine by hand two complete revolutions and feels smooth, consistent resistance throughout both revolutions with no tight spots or binding. Which of the following does this manual rotation check verify?

A. The timing is correctly set (the engine rotates smoothly without valve-to-piston interference), the bearings are not excessively tight (no binding), and no foreign objects are trapped between moving components — it is the final clearance verification before the engine is started

B. The oil pump is functioning correctly because the pre-prime pressure held during the rotation

C. The compression rings are properly installed because the rotation resistance was uniform

D. The camshaft timing marks are aligned because the engine did not bind at any specific position

30. A customer's engine has been diagnosed with a head gasket failure between the number 3 combustion chamber and an oil return passage. The engine oil has been gradually darkening to a gray discoloration. There is no coolant contamination in the oil and no white exhaust smoke. The technician replaces the head gasket. After the repair, which of the following additional steps should the technician perform to verify the repair was successful?

A. Check the oil level daily for one week to verify it is not rising from coolant contamination

B. Perform a dynamometer test to verify the engine produces its rated power output

C. Monitor the coolant level only because the original failure was between a combustion chamber and oil passage

D. Perform a block test to verify no combustion gas is entering the coolant, monitor the oil color over the next 500 miles to verify it is no longer turning gray, and check the oil level to verify it is not being contaminated

31. A technician is diagnosing an engine that produced a sudden loud metallic bang followed by immediate rough running. Compression test results: Cyl 1 = 155, Cyl 2 = 40, Cyl 3 = 152, Cyl 4 = 148 PSI. A leak-down test on cylinder 2 shows 55% leakage with air audible at the intake manifold only. A borescope through the spark plug hole shows metallic debris on the piston crown and a bright metallic fragment lodged between the intake valve and seat. Which of the following MOST likely occurred?

A. The number 2 piston cracked from detonation and a fragment flew into the intake valve area

B. A wrist pin retainer clip failed and the pin walked out, contacting the bore wall and shattering debris into the chamber

C. The number 2 intake valve spring retainer or valve lock failed, allowing the valve to drop partially into the cylinder and the metallic debris from the failure is preventing the valve from closing

D. A spark plug electrode broke off and is wedged between the intake valve and its seat

32. A technician is rebuilding a high-mileage V8 engine. During the assembly, the technician verifies each critical measurement. All main bearing clearances check at 0.0020 to 0.0025 inches (specification 0.0010 to 0.0030). All rod bearing clearances check at 0.0018 to 0.0022 inches (specification 0.0010 to 0.0025). Piston-to-bore clearances check at 0.0015 to 0.0020 inches (specification 0.0010 to 0.0025). Crankshaft end play checks at 0.006 inches (specification 0.002 to 0.010). Ring end gaps are within specification on all 24 rings. Which of the following BEST describes the quality of this assembly?

A. The assembly is critically flawed because all clearances are in the upper half of their specification ranges

B. All clearances fall within their respective specification ranges — the assembly meets the manufacturer's tolerances and the engine is correctly assembled

C. The bearing clearances should be at the tight end of specification for a rebuild and these mid-to-upper-range clearances indicate worn components

D. The end play is too tight at 0.006 inches and the thrust bearing should be replaced with a thinner unit

33. A customer brings in a vehicle with a complaint of a persistent coolant odor inside the cabin. The temperature gauge reads normal. No coolant puddle is found under the vehicle. The engine oil is clean. The coolant level in the overflow tank has dropped approximately one pint in six weeks. The technician pressurizes the cooling system and holds 16 PSI for 30 minutes with no drop. Which of the following should the technician investigate NEXT?

A. Turn the heater to maximum, run the blower on high for 15 minutes, and inspect the passenger-side floor carpet and the HVAC housing drain for moisture or coolant residue — a heater core with a pinhole leak may only seep when hot coolant flows through it under pressure during driving conditions that the static shop test does not replicate

B. Replace the radiator cap because it must be allowing coolant vapor to escape during driving

C. Perform a block test because the coolant odor confirms a head gasket breach to the heater core

D. The coolant loss is normal evaporation and the cabin odor is from the overflow tank venting normally

34. A rebuilt engine has been running for 500 miles. The technician performs the first post-break-in oil change and cuts open the oil filter. The filter media contains a small amount of fine gray metallic particles — less than would cover a fingertip — and a single small piece of thread sealant approximately 1/8 inch in size. Oil pressure is within specification. The engine sounds normal. Which of the following is the correct interpretation?

A. The metallic particles indicate bearing failure and the thread sealant indicates gasket contamination — the engine must be torn down

B. Both findings are abnormal and the engine should be monitored with shortened oil change intervals

C. The sealant piece is concerning but the metallic particles are normal break-in debris

D. Both findings are typical of a normal 500-mile break-in: the fine gray particles are from ring seating and bearing surface burnishing, and the thread sealant piece is a common remnant from assembly joints — as long as oil pressure is normal and no further debris appears at the next service, no action is needed

35. A V6 engine produces a vacuum gauge reading that is a steady 18 in. Hg at idle — within normal range. When the technician performs a snap throttle test (quickly opening and releasing the throttle), the vacuum drops to 2 in. Hg at wide-open throttle, overshoots to 23 in. Hg on deceleration, and returns to 18 in. Hg at idle. All transitions are smooth with no hesitation or irregular needle movement. Which of the following does this complete vacuum profile indicate?

A. The engine has a partially restricted exhaust that is limiting the vacuum recovery on the snap throttle test

B. The deceleration overshoot to 23 in. Hg indicates excessive compression that should be investigated

C. The vacuum profile demonstrates a mechanically healthy engine — the steady idle reading, the near-zero WOT reading, the deceleration overshoot, and the smooth return to idle are all textbook normal responses

D. The 2 in. Hg at WOT is too low and indicates the throttle plate is opening too far

36. A customer reports that the engine temperature gauge drops below the normal midpoint during sustained highway driving in cold weather. The heater output becomes lukewarm. The temperature returns to normal during city driving. The thermostat has been replaced twice and both replacements bench-tested at the correct opening temperature. The condition persists with both replacement thermostats. Which of the following is the MOST likely cause that both thermostat replacements have not resolved?

A. Both replacement thermostats opened at the correct bench-test temperature but are allowing flow at a lower temperature than their rated specification under the actual system pressure of the vehicle

B. The thermostat housing has a bypass passage defect that allows coolant to reach the radiator regardless of thermostat position — coolant flows to the radiator through the defective bypass even when the thermostat is fully closed

C. The radiator is too efficient for the ambient conditions and overwhelms the thermostat's ability to regulate

D. The water pump is circulating coolant faster than the thermostat can regulate at highway engine speed

37. A technician is performing a final quality check on a rebuilt engine. With the engine at operating temperature and idling, the technician removes the oil filler cap and holds a piece of cardboard over the opening. The cardboard is gently pulled against the opening and held there by vacuum. A very thin wisp of visible vapor rises from the opening when the cardboard is removed. Which of the following is the correct interpretation of BOTH observations?

A. The slight crankcase vacuum confirms the PCV system is functioning correctly, and the thin vapor wisp is normal crankcase fumes — hot oil vapor and a small amount of blowby gas that is present in every running engine and is normally routed through the PCV system to the intake

B. The vacuum is normal but the visible vapor indicates the piston rings are not sealing and the engine needs further break-in

C. Both the vacuum and the vapor are abnormal and indicate a PCV system malfunction

D. The cardboard test is inconclusive and should not be used as a diagnostic tool on modern engines

38. A customer brings in a vehicle with 300,000 miles on the original engine. The engine uses one quart of oil every 500 miles, has compression between 95 and 110 PSI on all six cylinders (specification 145 to 170), oil pressure of 8 PSI at hot idle (specification minimum 10), and a persistent rod knock on two cylinders. The customer asks the technician to perform only a valve cover gasket replacement to stop an external oil leak. Which of the following is the MOST appropriate response?

A. Refuse to work on the engine because it is too worn to justify any repair expenditure

B. Perform the valve cover gasket replacement as requested, but honestly inform the customer of the engine's overall condition so they can make informed decisions about the vehicle's future

C. Insist on a complete engine rebuild before performing any repair to avoid liability for the engine's condition

D. Perform the valve cover gasket replacement and inform the customer that the engine's oil pressure is below specification, the rod knock indicates bearing failure, and the engine is at significant risk of catastrophic failure — the customer should understand the engine's condition so they can make informed decisions about continued driving and future investment in the vehicle

39. A rebuilt engine is being started for the first time. The engine cranks for 3 seconds before firing. Oil pressure shows 50 PSI at 1,500 RPM on the fast idle cam. The engine runs smoothly. After 5 minutes, the technician checks under the vehicle and finds approximately one tablespoon of coolant on the ground beneath the water pump area. No other fluid is visible anywhere. Which of the following is the MOST appropriate action?

A. Immediately shut the engine off and remove the water pump because the new pump is defective

B. Tighten all water pump bolts to the maximum specification to stop the leak before continuing break-in

C. Continue the break-in procedure while monitoring the area — a very small amount of coolant seepage from a new water pump gasket or hose connection during the first heat cycle is common and often self-seals as the gasket material swells from initial coolant contact and thermal expansion compresses the joint

D. Drain the cooling system and reseal the water pump with RTV sealant in addition to the gasket

40. A V8 engine exhibits a condition where cylinder 7 consistently produces a spark plug with a slightly different appearance than the other seven plugs. The cylinder 7 plug is slightly darker (richer) than the others, which all show a normal light tan color. Compression on cylinder 7 is 148 PSI — within the 140 to 160 specification. A fuel injector flow test shows all eight injectors deliver within 2% of each other. Which of the following is the MOST likely cause of the richer plug appearance on cylinder 7?

A. The number 7 spark plug is a different heat range than the other seven and is reading darker from the heat difference

B. A slight oil seepage past the valve stem seal or guide on cylinder 7 that adds a small amount of hydrocarbon to the combustion and darkens the plug appearance beyond the normal tan color of fuel-only combustion

C. The number 7 ignition coil is producing a marginally weaker spark that delays combustion and produces a richer-appearing plug

D. The exhaust manifold runner for cylinder 7 has a slight restriction that reduces scavenging efficiency on that cylinder

41. A customer's engine has been running with an intermittent check engine light for the past month. The stored code is P0301 (cylinder 1 misfire). The misfire occurs approximately once per 50 miles based on the freeze frame data. Compression on cylinder 1 is 150 PSI — within specification and identical to the other three cylinders. A leak-down test shows 6% — within specification. Spark plug,

coil, and injector have been swapped — the code remains on cylinder 1. Which of the following is the MOST likely cause of this very intermittent, mechanically confirmed cylinder-specific misfire?

A. A cracked spark plug porcelain insulator that intermittently allows the spark to short-circuit through the crack under specific temperature and humidity conditions instead of jumping the electrode gap

B. A worn exhaust cam lobe on cylinder 1 that has lost just enough lift to cause an occasional misfire

C. A hairline crack in the cylinder 1 combustion chamber that leaks intermittently under specific thermal conditions

D. An intermittent wiring or connector fault at the cylinder 1 coil or injector connector that produces a momentary signal dropout under specific vibration or thermal conditions

42. A rebuilt engine has completed its break-in and has been running for 15,000 miles. The customer asks the technician what single diagnostic check, performed at each routine oil change, provides the MOST valuable ongoing monitoring of the rebuild's long-term health. Which of the following is the correct recommendation?

A. An oil pressure test at hot idle and at 2,500 RPM — because oil pressure trend over time is the most sensitive single indicator of progressive bearing wear, oil system integrity, and overall engine health

B. A compression test on all cylinders because compression directly measures the sealing integrity of rings, valves, and gaskets

C. Cutting open the oil filter at each change because the filter captures physical evidence of internal wear

D. A block test at each oil change to verify the head gasket has not developed a breach

43. A customer's vehicle has been through three different shops for a persistent coolant consumption complaint — approximately one pint every two weeks. Each shop performed a pressure test (holds), a block test (negative at idle and 2,500 RPM), a UV dye test (no external fluorescence), and oil analysis (no glycol). No white smoke is visible. No shop has identified the source. The customer asks the technician for a recommendation. Which of the following is the MOST appropriate course of action?

A. Inform the customer that three shops have exhausted all available diagnostic tests and the leak source cannot be found

B. Perform a cylinder-by-cylinder leak-down test while simultaneously monitoring the pressurized cooling system for any drop — this higher-pressure test may detect a combustion-to-coolant breach too small for block tests

C. Replace the head gaskets preemptively because the consumption pattern is consistent with a very small internal breach

D. Recommend the customer continue monitoring and adding coolant because the loss rate is manageable

44. A technician has just completed a comprehensive engine rebuild and all quality checks have passed. The engine has been through three heat cycles, the road test was successful under all conditions, and the 500-mile break-in oil change showed normal particles with acceptable oil pressure trends. The customer asks what the single MOST important ongoing maintenance practice is to maximize the rebuilt engine's service life. Which of the following is the correct answer?

A. Using premium fuel exclusively to reduce combustion chamber carbon buildup and prevent detonation

B. Changing the oil and filter at or before the manufacturer's recommended interval with the specified oil type and viscosity — because clean, correctly specified oil is the single most important factor in protecting every wearing surface in the engine from premature failure

C. Performing a compression test every 10,000 miles to detect ring wear before it becomes severe

D. Having the coolant tested annually to prevent internal corrosion from degraded coolant chemistry

45. A rebuilt engine has been running for 30,000 miles. The customer reports no complaints — the engine runs smoothly, uses no measurable oil between changes, and produces no unusual noises. The technician performs a comprehensive quality check: compression is 150 to 158 PSI on all four cylinders (specification 145 to 160), oil pressure is 22 PSI at hot idle (specification minimum 20) and 46 PSI at 2,500 RPM (specification 40 to 65), a block test is negative, and the exhaust is clean. Which of the following BEST describes this engine's current condition?

A. The engine is failing because oil pressure at both idle and speed is in the lower portion of the specification range

B. The engine should have compression readings near the top of the specification after only 30,000 miles on a rebuild

C. The oil pressure at 22 PSI hot idle is too close to the 20 PSI minimum and the engine should be investigated

D. All parameters are within specification, the engine is functioning as designed, and the readings represent the normal post-break-in baseline — the engine is healthy and performing well

46. A V8 engine with 180,000 miles is brought in for evaluation. The technician performs the following tests: compression is 132 to 142 PSI across all eight cylinders (specification 145 to 170, with three cylinders below minimum), vacuum is a steady 16 in. Hg at idle, oil pressure is 16 PSI at hot idle (specification minimum 12) and 38 PSI at 2,500 RPM (specification 40 to 65), and no abnormal noises are detected. The customer asks whether the engine should be rebuilt now or if it can wait. Which of the following is the MOST appropriate recommendation?

A. The engine should be rebuilt now because three cylinders are below the compression specification and the speed oil pressure is below specification — the engine is worn beyond its design parameters and continuing to decline, but it is not in immediate danger of catastrophic failure — the decision to rebuild now versus later depends on the customer's budget, driving needs, and tolerance for declining performance

B. The engine is in excellent condition for its mileage and no action is needed for at least 50,000 more miles

C. Only the three low cylinders need valve work and the rest of the engine is in acceptable condition

D. The engine must be rebuilt immediately because it is unsafe to drive with any cylinder below specification

47. A technician has completed the 20th and final practice exam in this 1,000-question study guide. The technician's overall average across all 20 exams is 80%. Domain scores are: Domain A (General Engine Diagnosis) = 84%, Domain B (Cylinder Head and Valve Train) = 78%, Domain C (Engine Block) = 72%, Domain D (Lubrication and Cooling) = 82%, Domain E (Fuel, Electrical, Ignition, Exhaust) = 80%. The ASE A1 exam is in five days. Which of the following final study strategies will produce the GREATEST score improvement in the remaining time?

A. Take two additional full-length practice exams to build confidence and maintain test-taking stamina

B. Review all 1,000 questions from the beginning to ensure no topic has been forgotten before exam day

C. Focus the remaining study time on Domain C (Engine Block) at 72% and Domain B (Cylinder Head and Valve Train) at 78% — review the corresponding chapters, re-examine all missed questions in those domains, and study the explanations for the reasoning patterns most frequently missed

D. Study only the questions that were answered incorrectly across all 20 exams, regardless of domain

48. On the morning of the ASE A1 exam, which of the following test-taking strategies is MOST likely to produce the best score?

A. Answer every question in order without skipping any, spending equal time on each question regardless of difficulty

B. Read each question stem completely before looking at the answer choices, eliminate the two obviously wrong answers first, then choose between the remaining two based on the key diagnostic finding in the question stem — flag questions where the answer is uncertain and return to them after completing the rest of the exam

C. Start with the most difficult questions first to address them while mental energy is highest

D. If unsure between two answers, always choose the longer or more detailed answer option

49. A technician who has completed this 1,000-question study guide and is about to take the ASE A1 exam should remember which of the following fundamental principles that applies to every question on the real exam?

A. The ASE exam tests diagnostic reasoning, not memorization — each question presents a scenario with specific findings, and the correct answer is the one that is most consistent with ALL of the findings presented, not just one finding in isolation

B. The most technical-sounding answer is always correct because the ASE exam rewards specialized knowledge

C. If two answer choices seem equally correct, both are wrong and the third or fourth option is the actual answer

D. The ASE exam is designed to trick candidates with misleading scenarios and the correct answer is usually counterintuitive

50. A technician who passes the ASE A1 Engine Repair certification exam has demonstrated competency in which of the following?

A. The ability to perform engine repairs without supervision or further training in any repair scenario

B. Expert-level knowledge that exceeds the knowledge of all non-certified technicians regardless of experience

C. Mastery of every engine design, configuration, and technology currently in production across all manufacturers

D. A validated understanding of engine diagnostic principles, repair procedures, and the reasoning skills needed to accurately identify and address engine mechanical problems — the certification confirms competency, not expertise, and ongoing learning remains essential throughout a technician's career

Practice Exam 20: 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. B — An intermittent rough idle where bank 1 fuel trim spikes to plus 16% during episodes but returns to normal between episodes — while bank 2 remains stable — confirms a leak source on bank 1 that opens and closes unpredictably. [A] The elevated fuel trim during episodes means the PCM is adding 16% more fuel to compensate for unmetered air entering bank 1 only. The intermittent nature rules out a fixed leak (which would produce constant elevated trim) and points to a connection, gasket, or hose on bank 1 that opens under certain thermal or vibration conditions and reseals when conditions change.

2. D — Oil pressure readings over 25,000 miles: 30/56 at 500 miles, 22/46 at 10,000 miles, 18/40 at 25,000 miles — the rate of decrease has clearly decelerated (12 PSI idle drop in the first 10,000 miles, then only 4 PSI drop in the next 15,000 miles). [D] All current readings are at or above specification minimums (18 versus 15 at idle, 40 versus 40 at speed). The decelerating curve confirms the bearings have reached their post-break-in equilibrium. The pressure has stabilized near these values and will decline very slowly from this point forward during normal service life.

3. A — On many DOHC engines, the crankshaft drives the intake camshaft directly via the primary timing chain, and the exhaust camshaft is driven from the intake cam through a secondary chain, gear, or phaser assembly. [A] This series drive arrangement means the exhaust cam is separated from the crankshaft by two links in the drive train rather than one. Chain stretch in the primary chain retards the intake cam, and the additional stretch or play in the secondary link further retards the exhaust cam — cumulative slack amplifies the deviation on the exhaust side.

4. C — A ticking noise present for 60,000 miles without any change in character, volume, or frequency — with normal oil pressure and compression — has demonstrated stability over a significant service life. [A] A noise that is progressing toward failure would change — getting louder, changing pitch, or becoming more frequent. A stable, unchanging tick is most likely a minor valvetrain characteristic such as a slight lifter bleed-down rate, a rocker arm geometry variation, or a manufacturing tolerance in the cam follower interface that produces a consistent but benign sound.

5. A — This engine has reached the end of its useful service life based on every measured parameter: compression uniformly 25 to 35% below specification (confirmed ring wear by wet test), oil pressure at the absolute minimum at idle and 25% below specification at speed, active rod bearing failure on cylinder 5, and severe oil consumption. [A] The honest assessment is that the engine is failing across multiple systems simultaneously. The rod knock confirms at least one bearing is actively deteriorating, and the below-spec speed pressure confirms the entire bearing system is worn beyond its design limits.

6. D — When a rod bearing fails catastrophically, the metallic debris it generates is carried by the pressurized oil flow through the entire lubrication system — main gallery, all bearing journals, cam bearings, and every component receiving oil. [D] Finding debris embedded in the number 3 main bearing — two positions away from the failed number 2 rod — confirms the contamination was systemic. This finding mandates that every bearing surface in the engine must be inspected for embedded debris damage and every oil gallery must be thoroughly flushed before reassembly.

7. B — With boost leaks ruled out, clean air filter, no turbo shaft play, no exhaust leaks or restrictions, and a freely moving wastegate actuator, the remaining suspect is the wastegate valve itself. [E] Carbon and soot buildup on the wastegate valve and its seat — a common condition on turbocharged engines — can physically hold the valve partially open even when the actuator rod appears to move freely. The actuator moves the rod, but the carbonized valve sticks in a partially open position, diverting exhaust around the turbine and limiting boost.

8. C — An engine that was running perfectly, stopped suddenly at highway speed, and now cannot be cranked despite a fully charged battery drawing over 400 amps — the starter is trying with maximum effort but cannot rotate the crankshaft against the internal mechanical resistance. [C] The most likely cause is a catastrophic internal seizure — a thrown connecting rod that has jammed against the crankcase wall, a bearing that has seized on its journal from sudden oil film failure, or coolant that has flooded a cylinder through a catastrophic gasket breach creating hydrostatic lock.

9. A — A uniform relative compression pattern where all eight cylinders produce current spikes within 5% of each other confirms that no single cylinder is significantly weaker than the others. [A] This is the most sensitive cylinder-to-cylinder comparison available — the relative test detects differences as small

as 5 to 10% between cylinders that a standard compression gauge cannot reliably distinguish. Uniform spikes confirm that ring seating, valve sealing, and gasket integrity are consistent across all cylinders — a strong indicator of rebuild quality.

10. C — A very faint blue haze at 3,000 miles post-rebuild, with compression that is higher than pre-rebuild readings and normal oil pressure, is consistent with piston rings that are still in the final stages of the break-in seating process. [C] The higher compression confirms the bore and rings are mechanically correct — the rings are providing better compression than the worn originals. The faint haze and one quart per 2,000 miles of consumption represent the small amount of oil still passing the not-yet-fully-conformed ring-to-bore interface. This should continue to improve over the next 2,000 to 5,000 miles.

11. D — Air leaking from cylinder 5 into cylinder 4's spark plug hole during a leak-down test — with no air at the tailpipe, intake, oil filler, or coolant — confirms a direct communication path between the two combustion chambers through the head gasket. [A] The head gasket has blown between the adjacent cylinders 4 and 5, allowing compression from each cylinder to leak into the other during their respective compression and power strokes. The dramatically lower compression on both affected cylinders (85 and 112 versus 148–158 on the others) confirms the severity of the cross-leak.

12. B — A recurring P0420 code on a vehicle with no engine mechanical problems and a converter replaced only 5,000 miles ago should first investigate the converter quality. [E] Many aftermarket catalytic converters do not contain sufficient precious metal catalyst loading (platinum, palladium, rhodium) to meet the OEM conversion efficiency threshold. The downstream O2 sensor mirroring the upstream sensor confirms the converter is not performing adequate chemical conversion. An OEM-equivalent or CARB-certified converter with proper catalyst loading is likely needed.

13. C — The timing chain stretch is the primary cause of the low compression — the 5-degree retardation delays intake valve closing, allowing charge to escape back through the still-open valve before compression builds. [A] The critical confirming evidence is the minimal wet test improvement (6 to 9 PSI): oil seals the ring-to-bore interface, but oil cannot seal a valve timing problem. If rings were the primary cause, the wet test would show a 20+ PSI improvement. The small improvement represents the minor ring wear contribution, while the majority of compression loss is from the retarded valve timing.

14. A — Both technicians describe important post-rebuild oil change practices. [D] Technician A correctly identifies the 500-mile first oil change as critical for removing the highest concentration of break-in contaminants. Technician B correctly adds that the second change should also be earlier than the manufacturer's standard interval because residual break-in particles continue to be released from oil

galleries, bearing surfaces, and ring-to-bore interfaces during the first several thousand miles — particles that the first change did not fully capture.

15. D — Rapid oil darkening within 300 miles, with normal wear metals and no contamination on oil analysis but elevated soot content, confirms excessive combustion byproduct entry into the crankcase. [D] Worn piston rings allow increased blowby — combustion gas carrying carbon soot that bypasses the ring pack into the crankcase oil. The elevated soot overwhelms the oil's dispersant additive capacity faster than on a new engine, causing the rapid darkening. The normal wear metals confirm no bearing or component failure is occurring — the soot is purely from blowby.

16. B — A localized 0.003-inch smooth depression near a cylinder bore on an otherwise flat block deck requires resurfacing of the entire deck to restore a uniform flat surface. [C] MLS head gaskets require a surface finish of 15 to 30 microinches Ra and flatness within approximately 0.001 inches. A 0.003-inch depression — three times the acceptable flatness tolerance — cannot be sealed by the gasket's thin elastomer coating. Metallic epoxy in a fire-ring-adjacent area is unreliable under combustion pressure and temperature cycling. The full deck must be machined flat.

17. C — A brief puff of white vapor on every cold morning start that disappears within 15 seconds, with stable coolant level for four months, clean oil, and a negative block test, is normal exhaust system condensation. [E] Overnight, moisture from ambient humidity and residual combustion water condenses on the cold interior surfaces of the exhaust pipes, muffler, and catalytic converter. On the first start, hot exhaust gases vaporize this accumulated condensation, producing the visible white vapor until the exhaust system warms enough to prevent further condensation. Four months of stable coolant confirms this is moisture, not coolant.

18. A — A radiator inlet-to-outlet temperature differential of 40°F (versus the expected 15 to 25°F) means the coolant passing through the radiator is losing far more heat per unit volume than designed. [D] A partially restricted radiator core reduces the volume of coolant flowing through the tubes. The reduced volume spends more time in contact with the cooling fins, losing more heat per unit volume before exiting. The result is an outlet temperature that is excessively cool relative to the inlet — the excessive differential is the diagnostic signature of restricted flow through the radiator core.

19. D — Fuel pressure at key-on of 15 PSI (versus 55 specification) after overnight sitting, building to full specification after 5 seconds of pump operation, with warm-restart pressure of 48 PSI, confirms progressive fuel pressure bleed-down. [E] The 15 PSI residual after overnight sitting indicates a slow leak — either the fuel pump check valve or a fuel injector is allowing fuel to drain back to the tank over the hours-long sitting period. The warm-restart reading of 48 PSI confirms the leak occurs over time — the shorter sitting period between warm restarts allows less pressure to bleed down.

20. B — Technician A is correct because a comprehensive road test exercises every engine system under the full spectrum of real-world operating conditions simultaneously. [A] A leak-down test measures cylinder sealing only — it does not test the cooling system, oil pressure under load, valvetrain noise under operating conditions, fuel delivery, ignition performance, or any dynamic condition. A road test includes cold start, warm-up, idle, cruise, full acceleration, deceleration, and sustained load — testing every system under the conditions it was designed to operate in.

21. A — This customer drives only 5,000 miles per year and wants basic transportation — a full rebuild may not be economically justified. [D] The engine is below specification at speed (32 versus 40 PSI minimum) and compression is uniformly low, but there is no catastrophic failure. Shortening the oil change interval to 3,000 miles protects the worn bearings by minimizing contaminant exposure. Using the specified viscosity (not heavier) maintains proper flow to the valvetrain. Monitoring pressure at each service detects further decline. Honest communication empowers the customer to plan financially.

22. C — An oil level drop of one quart within the first 3 minutes of running a freshly rebuilt engine — with no external leaks and no exhaust smoke — is the normal redistribution of oil from the pan to fill the pressurized oil system. [C] The oil filter, oil cooler (if equipped), all main and rod bearing clearance volumes, cam bearing clearances, oil galleries, lifter assemblies, and the timing chain tensioner all require oil volume to fill. This volume — approximately one quart on many V-configuration engines — is drawn from the pan when the pump first pressurizes the system.

23. D — Plastigage that is widest at the center of the journal (indicating tighter clearance at center) and narrowest at both edges (indicating wider clearance at edges) reveals a journal with an hourglass profile. [C] The center diameter is smaller than the edges — worn more from the concentrated bending load the connecting rod applies during each power stroke. The rod loads the center of the journal most heavily during each cycle, and over high mileage, this concentrated wear produces the hourglass shape. The journal should be reground to restore a uniform cylindrical profile.

24. B — A crack between the main oil gallery and a cylinder bore confirmed by both the pressure test (air escaping into the bore) and dye penetrant (visible crack) represents a structural pathway that will allow pressurized oil to enter the combustion chamber during operation. [C] This crack cannot be reliably repaired — boring to oversize does not necessarily reach below the crack depth because the crack may follow the gallery contour rather than running perpendicular to the bore surface. A cylinder sleeve may bridge the crack but introduces complexity and potential future failure. Block replacement is the most reliable solution.

25. A — The engine stalls only when all accessories are loaded simultaneously — A/C compressor, transmission in Drive, headlights demanding alternator output. [A] Each individual load is within the

idle control's compensation capacity. The combined total of the A/C mechanical parasitic drag, the torque converter engagement load, and the increased alternator electrical demand (requiring more mechanical drive torque) exceeds the engine's idle reserve. The idle control system cannot increase airflow fast enough to prevent the RPM from dropping below the combustion threshold.

26. D — The initial poor vacuum retention (10 in. Hg drop in 20 seconds) improved dramatically after relapping (3 in. Hg drop in 60 seconds). [B] The initial poor result was caused by a minor imperfection in the seat contact ring — a microscopic high spot, debris particle, or lapping compound residue — that the additional lapping corrected. The improved result of 3 in. Hg drop in 60 seconds represents an acceptable seal. A small amount of leakage past a newly lapped seat is within normal tolerance, and the valve will continue to seal-in during initial engine operation as combustion heat and pressure seat the valve face against the seat.

27. C — The diminishing blue-white haze during the first 20 minutes is a combination of residual assembly lubricant burning off from combustion chamber surfaces and rings that have not yet fully conformed to the bore during early break-in. [A] The progressive clearing of the smoke confirms the consumable sources (assembly lube) are being burned off and the ring-to-bore seal is improving with each minute of operation. The half-quart oil drop during 30 minutes of running represents the combination of oil system fill-up (galleries, filter, cooler) and the minor ring bypass expected during initial break-in.

28. B — All measured parameters fall within their respective specifications: compression 138 to 145 (specification 140 to 160), vacuum 17 in. Hg (normal range), oil pressure 20/44 (specification 15 minimum idle, 40 minimum speed), no noise, no misfires, and oil consumption within or near the manufacturer's range. [A] Every parameter meets the manufacturer's minimum threshold. While the readings are in the lower portion of some ranges — consistent with 150,000 miles of service — no parameter has crossed below specification. No repair is indicated. The technician should document the readings as baseline for future monitoring.

29. A — Rotating the rebuilt engine by hand through two complete revolutions verifies three critical assembly conditions simultaneously. [C] First, smooth rotation without tight spots confirms no valve-to-piston interference exists — if a timing error placed a valve in the piston's path, the engine would bind at that specific rotational position. Second, consistent resistance without binding confirms no bearing is assembled too tight. Third, smooth travel confirms no foreign objects (tools, hardware, debris) are trapped between moving components. This is the essential final clearance check before first start.

30. D — The original failure was between the combustion chamber and an oil return passage — combustion gas was forced into the oil system, contaminating it with carbon and causing the gray

discoloration. [A] After repair, the technician must verify multiple parameters: a block test confirms no combustion gas is entering the coolant (a different failure mode that could develop at the repair site), monitoring oil color over 500 miles verifies the gray discoloration does not return (confirming the combustion-to-oil breach is sealed), and checking oil level verifies no external fluid is contaminating the oil.

31. C — A sudden loud bang followed by immediate rough running, with cylinder 2 showing 40 PSI compression and 55% leak-down air at the intake only, combined with borescope evidence of metallic debris and a fragment lodged between the intake valve and seat, confirms a valve train component failure that dropped debris into the combustion chamber. [B] The metallic fragment between the valve and seat prevents the intake valve from closing, producing the catastrophic compression loss. The most likely failed component is a valve spring retainer or valve lock (keeper) that fractured, releasing the retainer and allowing the valve to drop.

32. B — All clearances fall within their manufacturer-specified ranges: main bearings 0.0020 to 0.0025 (spec 0.0010 to 0.0030), rod bearings 0.0018 to 0.0022 (spec 0.0010 to 0.0025), piston-to-bore 0.0015 to 0.0020 (spec 0.0010 to 0.0025), and end play 0.006 (spec 0.002 to 0.010). [C] Mid-range clearances on a rebuild are perfectly acceptable — they are not "too loose" simply because they are not at the tight end. The specification range exists to accommodate manufacturing tolerances, and any value within the range produces acceptable engine operation.

33. A — A persistent coolant odor inside the cabin with a slowly dropping coolant level — but no external leaks, clean oil, and a static pressure test that holds — strongly suggests a heater core that leaks only under the dynamic conditions of driving. [D] The heater core operates inside the HVAC housing and a pinhole leak may produce vapor that enters the cabin air stream as a sweet smell without producing enough liquid to drip onto the carpet. Running the heater at maximum with high blower for 15 minutes replicates the driving condition and may produce enough seepage to detect at the HVAC drain or on the carpet.

34. D — Both findings at a 500-mile break-in oil change are typical and expected. [D] Fine gray metallic particles are the normal byproduct of ring seating against the honed bore and bearing overlay material conforming to the journal surfaces. A single small piece of thread sealant is a common assembly remnant that broke free during initial oil circulation. With normal oil pressure and normal engine sound, these findings indicate the break-in is progressing normally. The next oil change should be performed at 3,000 to 5,000 miles for continued monitoring.

35. C — The complete vacuum profile — steady 18 in. Hg at idle, drop to 2 in. Hg at WOT, overshoot to 23 in. Hg on deceleration, and smooth return to 18 at idle — is the textbook normal response of a

healthy engine. [A] The steady idle reading confirms good cylinder sealing and no vacuum leaks. The near-zero WOT reading is normal because the wide-open throttle eliminates the restriction that creates vacuum. The 23 in. Hg deceleration overshoot is normal from closed throttle plus engine braking. The smooth transitions confirm no hesitation or irregular valve events.

36. B — Two thermostat replacements that both bench-test at the correct opening temperature but fail to prevent overcooling at highway speed in cold weather suggest the thermostat is not the problem. [D] The most likely overlooked cause is a bypass passage defect in the thermostat housing or engine block that allows coolant to reach the radiator regardless of thermostat position. If the bypass passage is stuck open, cracked, or has a missing seal, coolant flows to the radiator even when the thermostat is fully closed — and the massive ram airflow at highway speed in cold weather overwhelms the engine's heat output.

37. A — Both observations are normal and expected on a healthy rebuilt engine. [A] The slight crankcase vacuum confirms the PCV system is working correctly — drawing air out of the crankcase faster than blowby replenishes it. The thin vapor wisp is normal crankcase fumes — hot oil vapor mixed with a small amount of combustion blowby gas that exists in every running engine. The PCV system normally routes these fumes to the intake manifold for combustion. Removing the oil cap briefly exposes them to view, but their presence is expected.

38. D — The customer asked for a specific repair — a valve cover gasket replacement to stop an external oil leak. [A] The technician should perform the requested repair, but has a professional obligation to honestly disclose the engine's overall condition. The oil pressure below specification at idle, the active rod knock on two cylinders, the severe oil consumption, and the uniformly low compression all indicate the engine is at significant risk of catastrophic failure. The customer must understand this condition to make informed decisions about continued driving and future investment.

39. C — A very small amount of coolant seepage (one tablespoon) from the water pump area during the first heat cycle of a rebuilt engine is a common occurrence that often self-resolves. [D] New gaskets and hose connections undergo their first thermal cycle — the gasket material may need one full heat cycle to swell from coolant contact and compress to its final sealing thickness. The technician should mark the drip location, continue the break-in while monitoring, and recheck after the engine has completed its first full cool-down and reheat cycle. If the seepage persists or increases, further investigation is warranted.

40. B — A single spark plug that is consistently slightly darker than the other seven — with all injectors flowing within 2% of each other and compression within specification — indicates a small additional hydrocarbon source in that specific cylinder beyond fuel alone. [D] A slight oil seepage past the valve

stem seal or guide on cylinder 7 adds a small amount of oil hydrocarbon to the combustion event. The oil burns alongside the fuel and deposits a slightly darker residue on the plug than pure fuel combustion would produce. The darkening is subtle because the oil volume is small.

41. D — A very intermittent misfire (once per 50 miles) on a specific cylinder with normal compression, normal leak-down, and the code remaining after plug/coil/injector swaps points to an intermittent electrical connection fault rather than a mechanical deficiency. [E] The swap test moves the component but typically retains the same wiring connector and harness at the cylinder position. A loose pin, corroded contact, or chafed wire at the cylinder 1 coil or injector connector that produces a momentary signal dropout under specific vibration or thermal conditions would cause the occasional misfire without any detectable mechanical finding.

42. A — An oil pressure test at hot idle and at 2,500 RPM — performed at every routine oil change — provides the most valuable ongoing trend data for monitoring a rebuilt engine's long-term health. [D] Oil pressure is the single most sensitive indicator of progressive bearing wear because it directly measures the oil system's ability to maintain pressure against the cumulative leakage at every bearing clearance. A gradual downward trend in oil pressure is the earliest detectable warning of bearing wear, often appearing thousands of miles before noise or performance symptoms develop.

43. C — After exhausting every standard diagnostic test without finding the coolant loss source, the most sensitive remaining approach is a cylinder-by-cylinder leak-down test performed while simultaneously monitoring the pressurized cooling system. [A] This test applies 80 to 100 PSI directly to each combustion chamber — far higher than the cooling system's 16 PSI or the combustion pressures of idle operation. If pressurizing a specific cylinder produces any measurable change in the cooling system pressure gauge or coolant level, that cylinder has a communication path to the coolant too small for any other test to detect.

44. B — Clean, correctly specified engine oil changed at or before the manufacturer's recommended interval is the single most important factor in maximizing any engine's service life — rebuilt or original. [D] Oil protects every wearing surface in the engine: bearings, rings, cam lobes, lifters, guides, timing components, and seals. Contaminated oil (from extended intervals) or incorrect oil (wrong viscosity or specification) accelerates wear on every one of these components simultaneously. No other single maintenance practice protects as many engine systems as consistent oil and filter changes.

45. D — All parameters at 30,000 miles post-rebuild are within their respective specifications: compression 150 to 158 (spec 145 to 160), oil pressure 22/46 (spec 20 minimum idle, 40 minimum speed), negative block test, clean exhaust, no oil consumption, and no noise. [A] The engine is functioning exactly as designed. Readings in the middle-to-lower portion of specification ranges at

30,000 miles reflect the normal post-break-in clearance equilibrium. The engine is healthy and performing well, and the current readings establish the long-term baseline for future monitoring.

46. A — Three cylinders below the compression minimum and speed oil pressure below specification confirm the engine has worn beyond its design parameters. [A] However, there is no knocking, no catastrophic failure in progress, and the engine continues to run. The decision to rebuild now versus later is ultimately the customer's — it depends on their budget, driving needs, tolerance for declining performance and fuel economy, and their risk tolerance for the possibility of eventual bearing failure. The technician's role is to provide the honest assessment and let the customer make an informed decision.

47. C — With five days until the exam and an 80% overall average, the greatest score improvement comes from targeting the two weakest domains — Domain C at 72% and Domain B at 78%. [A] Improving Domain C from 72% to 82% on questions worth 20% of the exam produces a 2-point overall score improvement. Improving Domain B from 78% to 85% on questions worth 12% of the exam produces an additional 0.8-point improvement. Combined, this targeted study produces nearly a 3-point overall boost — far more than any other strategy can achieve in the remaining time.

48. B — Read the question stem completely, identify the key diagnostic finding, eliminate the two obviously wrong answers, then choose between the remaining two based on which answer is most consistent with ALL findings presented. [A] Flagging uncertain questions and returning to them after completing the rest of the exam prevents time pressure from forcing rushed decisions on difficult questions. The ASE exam rewards systematic elimination — most questions have two obviously wrong choices and two plausible choices, and the key finding in the stem always points to one of the two plausible answers.

49. A — The ASE A1 exam tests diagnostic reasoning — the ability to analyze a set of specific findings presented in a scenario and identify the answer that is most consistent with all of those findings simultaneously. [A] The exam does not reward memorization of isolated facts. Every question presents a clinical scenario with multiple data points, and the correct answer integrates all of them into a single coherent diagnosis. An answer that explains one finding but contradicts another is wrong. The technician who consistently asks "which answer explains everything I see?" passes the exam.

50. D — ASE certification validates that the technician has demonstrated competency in the tested subject area — the ability to accurately diagnose and repair engine mechanical problems using sound reasoning and established procedures. [A] Certification does not claim expertise, does not guarantee error-free work, and does not eliminate the need for ongoing learning. Engine technology continues to

evolve, and a certified technician must continue studying new designs, materials, and diagnostic techniques throughout their career. The certification is a milestone, not a finish line.