

PRACTICE EXAM 9: ASE A1 ENGINE REPAIR SIMULATION (50 QUESTIONS)

1. A technician is evaluating an engine that cranks at normal speed but will not start. The spark plugs are dry — no fuel is present on any plug. The fuel pump can be heard priming when the key is turned on. A fuel pressure gauge connected to the rail reads 55 PSI at key-on, which meets specification. A compression test shows all cylinders between 145 and 155 PSI. Which of the following is the MOST likely cause of the no-start condition?

- A. Low compression that is borderline and insufficient to support combustion under cranking
- B. A fuel pump that reaches pressure at key-on but fails to maintain delivery during cranking
- C. An ignition system failure that is preventing spark from reaching the combustion chambers
- D. A restricted exhaust that creates so much back-pressure the engine cannot expel exhaust gas

2. A customer reports that the engine loses approximately one quart of coolant every two weeks. There are no external leaks visible. The engine oil is clean on the dipstick. A cooling system pressure test holds for 20 minutes with no pressure drop. A block test performed at idle is negative. However, the customer states the coolant loss is worse after long highway trips. Which of the following should the technician do NEXT?

- A. Repeat the block test at 2,500 RPM under load to increase cylinder pressure at the potential breach
- B. Replace the radiator cap because the static pressure test does not check cap function under heat
- C. Perform a coolant dye test by adding UV dye and driving the vehicle to find a hidden external leak
- D. Inform the customer that the pressure test and block test both ruled out any cooling system problem

3. A V8 engine produces a sharp metallic knock that is clearly audible at idle and becomes more intense when the throttle is quickly blipped from idle. The technician disables fuel injectors one at a time. When the cylinder 6 injector is disabled, the knock significantly decreases but does not disappear entirely. When the cylinder 5 injector is disabled, the knock decreases slightly. No other cylinders affect the noise. Which of the following BEST explains these findings?

- A. Cylinder 6 has a worn main bearing and cylinder 5 has a worn connecting rod bearing

- B. Both cylinders 5 and 6 have worn rod bearings that are producing overlapping knock patterns
- C. Cylinder 6 has a worn rod bearing and cylinder 5 shares the same main bearing journal
- D. Cylinder 6 has a worn rod bearing and the residual noise from cylinder 5 is transmitted through the adjacent crankshaft journal and main bearing

4. A technician is performing a valve job on a cylinder head and discovers that one intake valve has a stem diameter of 0.3115 inches. The specification is 0.3130 to 0.3140 inches. The valve guide bore measures 0.3155 inches, which is within the guide specification. Which of the following is the correct action?

- A. Install the valve as-is because the stem-to-guide clearance of 0.0040 inches is acceptable
- B. Replace the valve because the stem diameter is below the minimum specification
- C. Ream the guide to a smaller diameter to match the worn valve stem dimensions
- D. Knurl the valve stem to increase its diameter and reduce the stem-to-guide clearance

5. An engine with 85,000 miles develops a P0420 (catalyst efficiency below threshold) code. The technician replaces the catalytic converter. Within 500 miles, the P0420 code returns. The engine has no misfire codes and runs normally. Oil consumption is one quart every 1,500 miles with faint blue haze from the exhaust during acceleration. Which of the following is the MOST likely reason the code returned?

- A. The replacement catalytic converter is defective and was faulty from the factory packaging
- B. The engine's oil consumption is contaminating the new converter's catalyst material with phosphorus
- C. The downstream oxygen sensor is faulty and giving a false reading of converter inefficiency
- D. The upstream oxygen sensor has drifted out of calibration and is causing inaccurate fuel trim data

6. Technician A says that an engine with a compression reading of 180 PSI on all cylinders — 15 PSI above the manufacturer's maximum specification of 165 PSI — may have excessive carbon buildup in the combustion chambers. Technician B says that higher-than-specified compression readings can contribute to detonation. Who is correct?

- A. Both Technician A and Technician B

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

7. A vehicle with a supercharged V8 engine is brought in with a complaint of a high-pitched whine that increases with engine RPM and a noticeable loss of power. The supercharger belt is intact and the pulley spins. Boost pressure on the scan tool reads 2 PSI below the specified peak. Which of the following is the MOST likely cause?

- A. A wastegate that is stuck open and diverting exhaust gas away from the supercharger turbine
- B. A clogged intercooler that is creating back-pressure between the supercharger and the engine
- C. A restricted air filter that is limiting the volume of air entering the supercharger compressor inlet
- D. Worn supercharger rotor bearings or internal clearances that reduce pumping efficiency and create noise

8. A technician removes the thermostat housing on a four-cylinder engine to replace the thermostat and discovers heavy brown sludge and gel-like deposits inside the housing and visible in the coolant passages of the head. The coolant in the radiator appears murky brown. The customer's maintenance records show coolant flushes at the correct intervals but list two different coolant types used in the past three services. Which of the following is the MOST likely cause of the deposits?

- A. The engine has an internal oil leak that has been slowly contaminating the coolant system
- B. The coolant flush procedure was not performed thoroughly enough to remove old coolant
- C. Incompatible coolant types were mixed during the services, causing a chemical gel reaction
- D. The thermostat housing gasket has deteriorated and its material is dissolving into the coolant

9. A technician is diagnosing a vehicle with an intermittent stalling complaint that occurs only during rapid deceleration from highway speed. The engine always restarts immediately. All compression, fuel pressure, and ignition tests are normal. A vacuum gauge shows a momentary spike to 25 in. Hg during deceleration. Which of the following is the MOST likely cause?

- A. A dashboard brake booster check valve that is failing and creating excessive vacuum spike

- B. Worn piston rings that cannot seal against the high vacuum generated during deceleration
- C. A cracked intake manifold runner that opens under the extreme vacuum of rapid deceleration
- D. The IAC valve or electronic throttle is not providing adequate airflow during the closed-throttle event

10. A technician is measuring connecting rod bearing clearance using Plastigage on a freshly rebuilt engine. After torquing the rod cap and removing it, the Plastigage strip is so thin that it is barely visible and does not correspond to any value on the measurement scale. Which of the following does this indicate?

- A. The Plastigage was placed incorrectly and the measurement must be repeated with a new strip
- B. The bearing clearance is excessively wide and beyond the Plastigage scale's measurement range
- C. The rod cap was not torqued to the correct specification and needs to be retorqued before reading
- D. The crankshaft was accidentally rotated during the measurement, smearing the Plastigage strip

11. A vehicle's engine idles normally but produces a loud exhaust leak sound under acceleration that diminishes at idle. A visual inspection shows the exhaust manifold and gaskets appear intact. No cracks are visible on the manifold surface. Which of the following is the MOST likely location of the leak?

- A. An internal crack in the manifold that opens under thermal expansion during acceleration
- B. A failed gasket at the exhaust manifold-to-cylinder head joint that flexes under engine torque
- C. A loose exhaust manifold heat shield that vibrates against the manifold during acceleration
- D. A crack or failed gasket at the exhaust manifold-to-downpipe flange connection below the manifold

12. A technician is rebuilding a DOHC engine and must time the intake and exhaust camshafts independently. After installing the timing chain and aligning all marks, the technician rotates the engine two complete revolutions by hand. The crankshaft mark returns to its reference perfectly, but the exhaust cam mark is one tooth advanced from its correct position. The intake cam mark is correct. Which of the following is the MOST likely cause?

- A. The timing chain has already stretched enough in two revolutions to allow one tooth of deviation
- B. One of the exhaust cam sprocket alignment marks is slightly mispositioned from manufacturing

- C. The exhaust camshaft sprocket was installed one tooth off from the correct mark during assembly
- D. The chain tensioner is defective and is applying uneven tension to the exhaust side of the chain

13. A customer reports that the engine produces a loud backfire through the air intake when attempting to start the engine after it has sat for three weeks without being driven. After 10 seconds of cranking, the engine starts and runs normally. This has happened twice in the past two months. Which of the following is the MOST likely cause?

- A. A VVT cam phaser that drains oil during extended sitting and causes momentary timing misalignment
- B. A fuel pump check valve that loses pressure during sitting, requiring repressurization before starting
- C. Stale fuel that has partially evaporated during the three-week sitting period and resists ignition
- D. A weak battery that provides insufficient voltage to the ignition system during the initial cranking

14. A technician discovers that a rebuilt engine has low oil pressure at idle (12 PSI) despite using new standard bearings, a new oil pump, and the correct oil viscosity. The specification requires a minimum of 20 PSI at idle. All bearing clearances were verified with Plastigage during assembly and were within specification. Which of the following should the technician investigate FIRST?

- A. The crankshaft end play to determine if excessive axial movement is affecting pressure buildup
- B. The bearing clearance on the thrust bearing specifically, as it may have a unique tolerance issue
- C. Whether the old oil pump was inadvertently reinstalled instead of the new replacement pump
- D. The oil pump pickup tube-to-pump O-ring seal for an air leak that reduces pump priming efficiency

15. A four-cylinder engine has the following compression results: Cyl 1 = 160, Cyl 2 = 155, Cyl 3 = 0, Cyl 4 = 158 PSI. The engine cranks at an uneven speed — fast through cylinder 3 and slower through the others. Which of the following is the MOST likely cause of zero compression on cylinder 3?

- A. A severely burned valve on cylinder 3 that has eroded completely through the seating surface
- B. A catastrophic failure on cylinder 3 such as a dropped valve seat, a hole in the piston, or a broken valve
- C. A jumped timing chain that has affected only cylinder 3 while the other cylinders remain timed

D. A blocked intake port on cylinder 3 that prevents air from entering the cylinder during cranking

16. Technician A says that a torque wrench should be calibrated regularly to ensure accuracy. Technician B says that storing a click-type torque wrench at its lowest setting when not in use helps preserve calibration accuracy. 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

17. A vehicle owner states that the engine temperature gauge reads slightly above the normal midpoint position at all times — city driving, highway driving, idle, and under load. The gauge previously always sat at the exact midpoint. The coolant level is correct, the system holds pressure, and no codes are stored. The cooling fan activates at the correct temperature. Which of the following is the MOST likely cause?

A. A faulty temperature gauge cluster that has shifted its calibration and reads higher than actual

B. A cooling system that has developed a minor restriction reducing overall heat dissipation capacity

C. A slightly open thermostat that is allowing too much coolant flow and reducing cooling efficiency

D. A thermostat with a slightly higher opening temperature than the original that raises the setpoint

18. An engine block is being prepared for assembly after machining. The technician installs new cam bearings, freeze plugs, and oil gallery plugs. Before installing the crankshaft, the technician pressurizes the oil galleries with shop air at 80 PSI to check for leaks. Air is heard escaping from the number 2 cam bearing bore area. Which of the following is the MOST likely cause?

A. The number 2 cam bearing was pressed in too deep and is now partially blocking the oil passage

B. The oil gallery plug nearest to the number 2 cam bearing was not fully seated during installation

C. The number 2 cam bearing oil hole is misaligned with the block oil passage and air leaks around it

D. The block has a previously undetected crack between the oil gallery and the cam bearing bore area

19. A customer brings a vehicle in after hearing a loud metallic bang from the engine while accelerating onto the highway. The engine immediately began running very rough and the check engine light started flashing. The technician finds that cylinder 3 has zero compression while all others are normal. A borescope inspection through the spark plug hole reveals metallic debris on top of the piston crown and visible damage to the combustion chamber surfaces. Which of the following has MOST likely occurred?

- A. The number 3 piston has cracked from detonation and pieces have broken off into the chamber
- B. A valve on cylinder 3 has broken and dropped into the combustion chamber during operation
- C. The head gasket on cylinder 3 failed catastrophically and was shredded by the piston movement
- D. A spark plug electrode broke off and is bouncing around inside the cylinder 3 combustion chamber

20. A technician is inspecting the oil pan gasket surface on a cast aluminum oil pan removed during an engine rebuild. The pan rail is slightly warped — a straightedge reveals a 0.004-inch bow along the length. Which of the following is the correct repair?

- A. Replace the oil pan because aluminum pans cannot be straightened once they have warped
- B. Install a thicker gasket to compensate for the warpage and provide an adequate seal despite the bow
- C. Straighten the pan rail by carefully tapping it flat with a body hammer on a flat surface plate
- D. Apply a generous bead of RTV sealant to both surfaces to fill the gap created by the warpage

21. A rebuilt engine has been running for 1,000 miles. The customer brings the vehicle in stating that the engine has developed a very slight tick from the valvetrain that is audible only at idle with the hood open. Oil pressure is within specification. The tick is steady and does not change with engine temperature. The technician uses a stethoscope and isolates it to the number 1 intake rocker arm on this OHV engine. Which of the following should the technician check FIRST?

- A. The valve lash adjustment on the number 1 intake valve to verify it has not drifted from specification
- B. The number 1 intake lifter for internal failure by removing it and performing a bench compression test
- C. The camshaft intake lobe for cylinder 1 by removing the intake manifold and measuring lobe lift
- D. The number 1 intake pushrod for a bend by removing it and rolling it on a flat surface plate

22. A six-cylinder engine is diagnosed with a head gasket failure between cylinders 3 and 4. During the repair, the technician inspects the removed cylinder head and finds the deck surface has 0.005 inches of warpage. The manufacturer allows a maximum of 0.003 inches. The head has never been resurfaced. The maximum allowable resurfacing depth is 0.010 inches. After resurfacing, which of the following additional checks should the technician perform?

- A. Verify the compression ratio has not increased beyond specification from the material removed
- B. Verify that the piston-to-head clearance is still adequate and the valves will not contact the pistons
- C. Measure the exhaust manifold alignment to confirm the manifold ports still align with the head ports
- D. Confirm that the camshaft timing has not been affected by the change in head-to-block relationship

23. A technician is performing an oil consumption test on a customer's vehicle. The technician changes the oil and filter, fills to the exact full mark, and instructs the customer to return in 1,000 miles without adding oil. The customer returns at 1,012 miles. The oil level is 3/4 quart below the full mark. The manufacturer states that oil consumption of up to one quart per 1,000 miles is within normal parameters. Which of the following is the correct conclusion?

- A. The engine has a slight oil leak that should be located using UV dye and repaired promptly
- B. The oil consumption exceeds the manufacturer's allowable threshold and requires further diagnosis
- C. The technician should recommend an engine rebuild because any measurable consumption is abnormal
- D. The oil consumption of 3/4 quart per 1,000 miles is within the manufacturer's stated normal range

24. An engine with a belt-driven overhead camshaft produces a rhythmic slapping noise from the timing belt cover area at all temperatures and engine speeds. The timing belt was replaced 5,000 miles ago. Which of the following is the MOST likely cause?

- A. The timing belt has stretched prematurely and is slapping against the inside of the timing cover
- B. The replacement timing belt is an incorrect width or tooth profile for this engine application
- C. The timing belt tensioner was not adjusted properly and the belt has excessive slack
- D. The timing belt idler pulley bearing has failed and the pulley is wobbling on its shaft

25. Technician A says that a cylinder bore that has been honed with the correct crosshatch angle but cleaned only with solvent (no soap and water scrubbing) is ready for piston and ring installation. Technician B says that residual honing grit left in the crosshatch valleys acts as an abrasive that accelerates ring and bore wear during break-in. Who is correct?

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

26. A vehicle is towed in because the engine stopped suddenly while cruising at 55 mph. The engine will not crank — the starter engages and the solenoid clicks, but the crankshaft does not rotate. The battery is fully charged and the starter current draw reads over 400 amps. Which of the following is the MOST likely cause?

- A. A failed starter motor that is drawing excessive current but cannot produce rotation torque
- B. An internally seized engine that the starter motor cannot rotate despite maximum current draw
- C. A faulty ignition switch that is not delivering full voltage to the starter motor solenoid circuit
- D. A corroded battery cable connection that is limiting current delivery to the starter at high loads

27. A technician is assembling a rebuilt engine and needs to install the oil pump pickup tube. The technician measures the distance between the bottom of the pickup screen and the oil pan floor after temporarily installing the pan. The measurement reads 3/4 inch. The specification calls for 1/4 to 3/8 inch between the screen and the pan floor. Which of the following is the consequence of this excessive clearance?

- A. The oil pump will generate too much suction and cavitate during normal engine operation
- B. The excess distance will cause no problems because the screen is still submerged in oil at rest
- C. The pump will draw air during hard cornering, braking, or acceleration when oil sloshes away
- D. The pickup tube will draw oil from too far above the sediment layer at the bottom of the pan

28. A technician performs a cooling system pressure test and a block test on a vehicle with an unexplained coolant loss. Both tests are negative. The engine oil is clean. There is no sweet smell from the exhaust. The heater core hoses are both hot and the heater works normally. The technician adds UV dye to the coolant and drives the vehicle for 100 miles. Under UV light, faint fluorescence is found on the ground under the water pump area — but only on the side away from the weep hole. Which of the following is the MOST likely source?

- A. The water pump shaft seal has failed and coolant is leaking past the bearing to the outside
- B. The water pump gasket is leaking coolant at the pump-to-block mating surface on that side
- C. A coolant hose clamp near the water pump is loose and allowing a slow seep at the hose end
- D. The engine block has a casting porosity issue near the water pump that weeps coolant under pressure

29. A technician is rebuilding an engine that was diagnosed with a spun connecting rod bearing on cylinder 4. During disassembly, the technician inspects the crankshaft rod journal for cylinder 4 and finds it severely scored and discolored from heat. The journal diameter measures 0.012 inches below the standard specification. The maximum undersize regrind available is 0.030 inches. Which of the following is the correct approach?

- A. Regrind the journal to 0.020-inch undersize to clean up the scoring and install matching bearings
- B. Regrind only the damaged journal and leave the other rod journals at their current dimensions
- C. The scoring may be too deep for a single undersize cut — measure after cleanup grinding to determine which undersize specification the journal reaches
- D. Replace the crankshaft because a journal that is already 0.012 inches below standard cannot be reground

30. A vehicle with an inline-6 engine has a persistent rough idle with vacuum gauge readings that fluctuate rhythmically between 13 and 18 in. Hg. The fluctuation rate corresponds to approximately one dip per two crankshaft revolutions. Which of the following is the MOST likely cause?

- A. A vacuum leak at the intake manifold that is large enough to cause cyclic pressure changes
- B. A single cylinder with a burned valve that leaks compression during each of its power events
- C. A worn camshaft with multiple low lobes that reduces valve lift on several cylinders at once
- D. A restricted exhaust system that creates pulsating back-pressure affecting the vacuum reading

31. Technician A says that anti-seize compound should be applied to spark plug threads when installing plugs in cast iron cylinder heads. Technician B says that anti-seize should never be applied to spark plug threads in aluminum cylinder heads because it can cause over-torquing. Who is correct?

- A. Technician A only
- B. Both Technician A and Technician B
- C. Technician B only
- D. Neither technician is entirely correct — the spark plug manufacturer's specific recommendation should always be followed

32. A technician is evaluating an engine for a customer who wants to know if it needs a rebuild. The compression test shows: Cyl 1 = 135, Cyl 2 = 138, Cyl 3 = 132, Cyl 4 = 140 PSI. The manufacturer's specification is 145 to 170 PSI. All cylinders are below minimum but within 10% of each other. Oil pressure at hot idle is 18 PSI with a specification of 15 PSI minimum. The engine uses one quart of oil every 2,000 miles. Which of the following is the MOST accurate assessment to provide the customer?

- A. The engine has a single cylinder problem that should be repaired before the others deteriorate
- B. The engine needs immediate rebuilding because all compression readings are below specification
- C. The engine is significantly worn throughout but still functional and the decision to rebuild is based on the customer's tolerance for declining performance and oil consumption
- D. The engine is in acceptable condition because all cylinders are within 10% of each other

33. A technician discovers during an engine rebuild that the block deck surface has a network of very fine, shallow cracks radiating from the edge of the number 3 cylinder bore toward the head bolt holes. The cracks are visible only under magnification and do not appear to penetrate deeply. A dye penetrant test confirms they are surface cracks only. Which of the following BEST describes this condition?

- A. The cracks are casting stress marks from original manufacturing and are cosmetic and non-structural
- B. The cracks are thermal fatigue cracks from repeated heating and cooling cycles around the combustion chamber
- C. The cracks are caused by over-torquing of the head bolts during a previous assembly procedure
- D. The cracks indicate that the block material has crystallized from age and the block must be replaced

34. A technician is installing a new water pump on an engine where the water pump is driven by the timing belt. The old pump showed signs of bearing wear with slight shaft play. After installing the new pump and timing belt, the technician notices that the timing belt has slightly less tension than specified despite the tensioner being adjusted per the manufacturer's procedure. Which of the following is the MOST likely cause?

- A. The new water pump has a slightly different pulley diameter or offset than the original pump design
- B. The timing belt tensioner spring has weakened from age and cannot apply the specified tension load
- C. The new timing belt has stretched prematurely because it is an aftermarket belt of lower quality
- D. The timing belt was installed with incorrect routing around the water pump pulley and idler pulleys

35. An engine produces a distinct metallic rattling noise from the top of the engine that is present only during the first 500 RPM of deceleration from highway speed — the brief moment when the throttle is closed but the engine has not yet returned to idle. The noise is not present at steady idle, during acceleration, or at constant cruise. Which of the following is the MOST likely cause?

- A. Piston slap that becomes audible only during the momentary high-vacuum deceleration condition
- B. A loose heat shield on the exhaust manifold that resonates at the specific RPM of early deceleration
- C. Excessive valve lash that becomes audible when the valvetrain unloads during the deceleration event
- D. A VVT cam phaser that momentarily loses oil pressure during the rapid throttle transition to closed

36. A technician is performing an engine rebuild on a high-mileage V8. During block inspection, the technician finds that the cylinder bores on the left bank all measure within specification (maximum 0.001 inches taper, 0.0008 inches out-of-round) while the bores on the right bank show 0.004 to 0.005 inches of taper and 0.003 inches of out-of-round — all exceeding the 0.003-inch taper and 0.0015-inch out-of-round maximums. Which of the following is the correct repair approach?

- A. Bore and hone all eight cylinders to the same oversize for uniform displacement and balance
- B. Bore only the right bank cylinders to the next oversize and hone the left bank for standard rings
- C. Bore all eight cylinders because mixing standard and oversize bores creates an engine imbalance
- D. Hone all eight cylinders for new standard rings because the average wear is within acceptable limits

37. A technician is diagnosing a vehicle with a check engine light and a code P0172 (system too rich, bank 1). The long-term fuel trim on bank 1 is minus 18%, meaning the PCM is reducing fuel delivery by 18% to compensate for a rich condition. All engine mechanical tests are normal. Which of the following is the MOST likely engine-related cause of the rich condition?

- A. A leaking fuel injector on bank 1 that is delivering more fuel than commanded by the PCM
- B. A vacuum leak on bank 1 that is introducing unmeasured air and causing a lean condition
- C. A clogged air filter that is reducing airflow into the engine and enriching the mixture on all banks
- D. A failed upstream oxygen sensor on bank 1 that is falsely reading lean and causing over-fueling

38. A technician is disassembling an OHV engine and finds that one pushrod is noticeably shorter than the others — approximately 0.050 inches shorter. All pushrods are the same part number. The short pushrod came from the number 5 exhaust position. Which of the following is the MOST likely explanation?

- A. The number 5 exhaust pushrod is a different application that was installed during a previous repair
- B. The number 5 exhaust pushrod has been compressed by repeated contact from excessive valve lash
- C. The number 5 exhaust cam lobe is worn and the pushrod has seated deeper into the worn lifter cup
- D. The pushrod has been bent and shortened from a hydrostatic lock event on cylinder 5 at some point

39. A customer states that the engine runs fine but the oil pressure gauge reads lower than it did when the vehicle was newer. At hot idle, the gauge reads 20 PSI. At 2,500 RPM, it reads 45 PSI. The specification is 15 PSI minimum at idle and 40 to 65 PSI at 2,500 RPM. Both readings are within the manufacturer's specification. Which of the following is the MOST appropriate response?

- A. Recommend an immediate oil pump replacement because the readings are near the lower limits
- B. Recommend switching to a heavier viscosity oil to increase pressure readings across the board
- C. Inform the customer that both readings are within specification and the lower readings compared to new are normal age-related wear
- D. Recommend an engine rebuild because declining oil pressure indicates imminent bearing failure

40. A technician is replacing a timing belt on an interference engine. After removing the old belt, the technician rotates the crankshaft to position it at TDC — but the crankshaft will not rotate past a certain point despite moderate force on the breaker bar. Which of the following is the MOST likely explanation?

- A. The starter ring gear on the flywheel has a damaged tooth that is jamming against the starter
- B. A connecting rod bearing has seized from the vibration of removing the timing belt components
- C. The oil pump has locked up internally because the timing belt also drove the oil pump assembly
- D. A piston is contacting an open valve because the camshaft is out of phase with the crankshaft

41. A rebuilt engine passes all quality checks at 500 miles and the oil is changed. At 3,000 miles, the customer reports a knocking noise that is most noticeable during the first five minutes of cold operation and disappears when the engine is warm. Oil level is correct. Oil pressure is within specification at all temperatures. A stethoscope localizes the noise to the mid-block area. Which of the following is the MOST likely cause?

- A. A main bearing that was installed with insufficient clearance and is now overheating and knocking
- B. Piston slap from one or more pistons with slightly excessive bore clearance that closes when hot
- C. A timing chain guide that has cracked and vibrates against the chain until oil pressure steadies it
- D. A wrist pin that has developed excessive clearance during break-in and knocks until expansion closes it

42. A customer reports that the engine has gradually lost power over the past 20,000 miles. There are no codes, no misfires, and no unusual noises. Fuel economy has decreased approximately 10%. A compression test shows all six cylinders between 120 and 128 PSI. The specification is 148 to 168 PSI. A vacuum gauge reads 15 in. Hg at idle. Which of the following BEST explains the gradual power loss?

- A. Progressive generalized wear of piston rings and cylinder bores reducing compression and efficiency
- B. A gradually clogging catalytic converter that is creating increasing exhaust back-pressure over time
- C. A stretched timing chain that is slowly retarding valve timing as the chain elongates with wear
- D. Deteriorating spark plugs that are progressively losing their ability to ignite the mixture efficiently

43. A technician is testing a cooling system thermostat on the bench by suspending it in a pot of water with a thermometer. The thermostat is rated at 195°F. During the test, the thermostat begins to open at 185°F and is fully open at 215°F. Which of the following is the correct interpretation?

- A. The thermostat is opening 10°F below its rated temperature and should be replaced
- B. The thermostat is functioning perfectly because rated temperature is the full-open temperature
- C. The thermostat is functioning within normal tolerance because a plus-or-minus 5°F variance is typical
- D. The thermostat should be retested because ambient temperature may have affected the reading

44. A technician is investigating an oil leak on a recently rebuilt engine. Oil is seeping from the joint where the oil pan meets the rear main seal housing. The oil pan gasket and rear main seal were both replaced during the rebuild. The PCV system is functional and crankcase pressure is normal. Which of the following is the MOST likely cause of the leak at this specific joint?

- A. The rear main seal was installed incorrectly and is allowing oil to migrate along the housing surface
- B. The oil pan drain plug was over-torqued and has cracked the pan floor near the rear seal housing
- C. The engine block rear surface where the seal housing mounts has debris preventing a flush seal
- D. Inadequate or incorrectly applied sealant at the junction where the oil pan gasket meets the rear seal housing

45. A V8 engine has an unusual compression test pattern: cylinders 1, 3, 5, and 7 (left bank) all read 155 to 160 PSI, while cylinders 2, 4, 6, and 8 (right bank) all read 120 to 125 PSI. The specification is 145 to 170 PSI. Wet tests on the right bank cylinders show a 20 to 30 PSI improvement on each. Which of the following BEST explains why one entire bank has low compression with ring wear confirmed?

- A. The right bank cylinders received less oil during operation due to a partially blocked oil gallery
- B. A manufacturing defect in the right bank bore finish caused accelerated ring wear on that side
- C. The right bank cylinder bores have worn more due to an engine design factor such as cooling imbalance or oil distribution asymmetry
- D. All eight cylinders have equal ring wear but the right bank head gasket is also leaking compression

46. Technician A says that the proper way to remove a harmonic balancer from the crankshaft is to use a three-jaw puller designed for the application. Technician B says that hammering on the end of the crankshaft to drive the balancer off is acceptable if a proper puller is not available. Who is correct?

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

47. A rebuilt engine is being broken in. During the first 500-mile period, the customer reports that oil consumption is approximately one quart per 300 miles. There is a faint blue haze from the exhaust at all times. Oil pressure and compression are within specification. Which of the following is the MOST likely cause?

- A. The piston rings are not yet fully seated against the freshly honed bore surfaces during break-in
- B. The piston rings have not seated because the break-in procedure has not generated adequate cylinder pressure
- C. The cylinder bores were honed with too rough a finish that is preventing the rings from sealing properly
- D. The valve stem seals were not replaced during the rebuild and are leaking oil into every cylinder

48. A technician is inspecting the flywheel friction surface during a clutch replacement on a vehicle that also has an engine oil consumption complaint. The flywheel friction surface has a blue-black discoloration pattern and the surface appears glazed. There is also oil contamination visible on the friction surface. Which of the following is the MOST likely source of the oil on the flywheel?

- A. The front crankshaft seal that has failed and oil has migrated rearward along the block to the flywheel
- B. A leaking oil pan gasket at the rear of the pan that is dripping oil onto the flywheel housing below
- C. The oil filler cap was left loose during a previous service and oil has splashed onto the flywheel
- D. The rear main crankshaft seal that is leaking oil onto the flywheel through the rear seal housing

49. A technician is diagnosing a vehicle where the engine temperature gauge fluctuates noticeably — rising for 30 seconds, then dropping for 30 seconds — in a repeating pattern during highway driving. The coolant level is correct and the system holds pressure. Which of the following is the MOST likely cause?

- A. A thermostat that is rapidly cycling between open and closed due to a weakened wax element
- B. An air pocket trapped in the cooling system that circulates past the temperature sensor periodically
- C. A failing water pump that pulsates coolant flow due to a worn bearing allowing impeller wobble
- D. A coolant temperature sensor with a loose electrical connection causing intermittent signal drops

50. A technician is verifying the repair after replacing a head gasket on a four-cylinder engine. The engine has been run through two full heat cycles. A combustion leak test is negative. The coolant level has remained stable. The oil appears clean. However, the technician notices that the exhaust from the tailpipe has a very faint sweet smell that is barely detectable. All other tests are normal. Which of the following is the MOST appropriate action?

- A. Disassemble the engine again because the faint sweet smell confirms the new gasket has failed
- B. Ignore the smell because a negative block test definitively rules out any combustion-coolant breach
- C. Document the finding, monitor the coolant level over the next 500 miles, and retest if any change occurs
- D. Replace the catalytic converter because the sweet smell is likely from converter degradation not coolant

Practice Exam 9: 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. C — The engine has fuel pressure (55 PSI at key-on), compression (145–155 PSI on all cylinders), but the plugs are dry — meaning fuel is present in the rail but is not being injected or the injected fuel is not reaching the plugs because it is not being ignited. [A] With confirmed fuel pressure and confirmed

compression, the missing element is ignition. The dry plugs are consistent with either no spark (fuel is injected but immediately expelled unburned) or no injector pulse (fuel stays in the rail). A spark test and injector pulse check would confirm which ignition/fuel delivery component has failed.

2. A — A negative block test at idle does not rule out a head gasket breach that only leaks under higher cylinder pressures generated during loaded driving conditions. [D] The customer's observation that coolant loss worsens after long highway trips suggests the breach opens or worsens under the sustained high cylinder pressures of highway load. Repeating the block test at elevated RPM under load increases cylinder pressure at the potential breach point, forcing more combustion gas into the coolant — enough to change the test fluid if a leak exists.

3. D — The primary knock is from a worn rod bearing on cylinder 6 — confirmed by the significant decrease when that cylinder is disabled. [A] The slight decrease when cylinder 5 is disabled is explained by the fact that cylinders 5 and 6 on a V8 engine share an adjacent crankshaft main bearing journal, and removing the combustion load from cylinder 5 slightly reduces the overall force transmitted through the shared journal area, marginally reducing the impact intensity at the worn cylinder 6 rod bearing.

4. B — The valve stem diameter of 0.3115 inches is below the manufacturer's minimum specification of 0.3130 inches, indicating the stem has worn beyond its serviceable limit. [B] Regardless of guide condition, a valve with an undersize stem cannot be used because the resulting stem-to-guide clearance (0.3155 minus 0.3115 equals 0.0040 inches) exceeds the typical exhaust valve specification of 0.002 to 0.004 inches and will cause oil consumption, wobbling, and inconsistent seating. The valve must be replaced with a new one that meets the stem diameter specification.

5. B — An engine consuming one quart of oil every 1,500 miles with visible blue exhaust haze is burning oil in the combustion chambers, and the combustion byproducts — particularly phosphorus and zinc from the oil's anti-wear additive package — poison and coat the catalytic converter's precious metal catalyst material. [E] The contaminated catalyst cannot perform its chemical conversion function efficiently, triggering the P0420 code. Replacing the converter without addressing the oil consumption only installs a new converter that will be contaminated by the same ongoing oil burning.

6. A — Both technicians are correct. [A] Technician A is right: compression readings above the manufacturer's maximum specification indicate the combustion chamber volume has been reduced — most commonly by carbon deposits accumulating on the piston crown and chamber surfaces. Technician B is also right: the artificially elevated compression ratio increases peak cylinder pressure and temperature, creating conditions favorable for detonation even on fuel grades that would normally be adequate for the engine's design compression ratio.

7. D — A supercharger (not a turbocharger) is belt-driven and does not have a wastegate — eliminating option A. [A] The high-pitched whine increasing with RPM combined with reduced boost output points to worn internal components in the supercharger itself. Worn rotor bearings, enlarged rotor-to-housing clearances, or worn rotor tip seals reduce the supercharger's volumetric efficiency, decreasing boost output while the mechanical noise from the worn components increases with rotational speed.

8. C — Heavy brown sludge and gel deposits in the cooling system with documented use of two different coolant types is the hallmark of coolant incompatibility — specifically, mixing conventional green (IAT) coolant with extended-life orange (OAT) or hybrid (HOAT) formulations. [D] The different additive chemistries react with each other, forming a gel or sludge that coats surfaces, restricts passages, and reduces the coolant's heat transfer ability. The correct repair is a thorough flush with clean water until the system runs clear, followed by filling with a single compatible coolant type.

9. A — An engine that stalls specifically during rapid deceleration (closed throttle, high vacuum) with immediate restart and normal operation at all other times points to insufficient airflow during the closed-throttle deceleration event. [A] The 25 in. Hg vacuum spike is normal for deceleration, but a faulty or sluggish idle air control valve or electronic throttle that does not crack open quickly enough to admit bypass air during this event allows the RPM to drop below the combustion-sustaining threshold, causing a momentary stall.

10. B — A Plastigage strip that is so thin after compression that it barely registers on the measurement scale indicates the bearing clearance is very large — the journal and bearing surfaces were so far apart that the Plastigage was barely compressed at all. [C] On the Plastigage scale, a wider compressed strip means tighter clearance (more compression), and a thinner strip means looser clearance (less compression). A strip that is barely visible means the clearance exceeds the scale's maximum reading, confirming the bearing clearance is excessively wide and requires correction.

11. D — An exhaust leak that is louder during acceleration than at idle suggests the leak point is under greater pressure during the higher exhaust flow of acceleration. [E] While the manifold and its gaskets appear intact, the exhaust manifold-to-downpipe flange connection below the manifold is a common leak location that is easily overlooked during a visual inspection from above. The flange gasket deteriorates from heat cycling, and the bolts corrode and loosen, creating a joint that seals adequately at the low exhaust flow of idle but leaks under the higher pressures and volumes of acceleration.

12. C — If the crankshaft mark returns perfectly after two full revolutions but the exhaust cam mark is one tooth off while the intake cam mark is correct, the exhaust camshaft sprocket was installed one tooth from its correct position during the initial assembly. [B] A new chain would not stretch one tooth in two hand revolutions, and a tensioner issue would affect both cam sprockets, not just one. The error was

made during installation and was only revealed when the full two-revolution verification check was performed — which is exactly why this verification step is critical.

13. A — A loud intake backfire during cranking after the vehicle has sat for weeks, followed by normal operation once started, is consistent with a VVT cam phaser that has drained its oil during the extended sitting period. [A] With the phaser empty, the intake camshaft rests in a default position that may hold the intake valve partially open during what should be the compression stroke. The compressed charge pushes back through the open intake valve into the manifold, producing the backfire. Once oil pressure refills the phaser within seconds of cranking, timing corrects and the engine runs normally.

14. D — A freshly rebuilt engine with new bearings, new pump, correct viscosity, and verified clearances that still has low idle oil pressure most likely has an air leak at the oil pump pickup tube O-ring. [D] A damaged or missing O-ring where the pickup tube seats into the oil pump allows the pump to draw air along with oil, drastically reducing the pump's ability to build and maintain pressure. This is one of the most common assembly errors on rebuilt engines and is easy to miss because the O-ring is a small, easily overlooked component.

15. B — Zero compression on a single cylinder — an absolute zero reading with no pressure buildup whatsoever — indicates a catastrophic failure that has completely eliminated that cylinder's ability to contain any compression. [A] A burned valve, even a severely burned one, would typically produce some residual compression (20–40 PSI). True zero compression requires a complete breach — a dropped valve seat, a valve broken off its stem and fallen into the cylinder, a hole in the piston, or a similar catastrophic structural failure. The fast cranking speed through cylinder 3 confirms zero resistance.

16. A — Both technicians are correct. [C] Technician A is right: torque wrenches are precision instruments that drift out of calibration with use, impact, and age — regular calibration verification ensures accurate torque readings, which is critical for head bolts, rod bolts, and other fasteners with tight specifications. Technician B is also right: storing a click-type torque wrench at its lowest setting relaxes the internal spring when not in use, reducing spring fatigue and preserving calibration accuracy over time.

17. D — A temperature gauge that reads consistently slightly above its previous normal position at all driving conditions — not just under load — with normal fan operation, correct coolant level, and no codes suggests the thermostat is opening at a slightly higher temperature than the original. [D] If the replacement thermostat has a higher rated opening temperature (for example, 200°F instead of the original 195°F), the engine stabilizes at a proportionally higher operating temperature. The gauge reflects this higher setpoint across all conditions uniformly.

18. C — Air escaping from the number 2 cam bearing bore area when the oil galleries are pressurized indicates the oil supply passage is not connecting to the bearing properly. [C] The most likely cause is that the cam bearing was pressed in with its oil hole misaligned from the block's oil supply passage. The pressurized air follows the gallery to the bearing location but escapes around the bearing rather than flowing through the aligned oil hole into the bearing bore. The bearing must be removed and reinstalled with correct oil hole alignment.

19. B — A sudden loud metallic bang during acceleration followed by immediate rough running, zero compression on one cylinder, and visible metallic debris on the piston crown is consistent with a valve that has broken and dropped into the combustion chamber. [A] The broken valve pieces impact the piston crown, damage the combustion chamber surfaces, and prevent compression because the broken valve port is now an open hole. The flashing check engine light confirms continuous misfire. This is a catastrophic mechanical failure requiring cylinder head removal and inspection.

20. C — A cast aluminum oil pan with a 0.004-inch bow along the rail can often be straightened by carefully tapping the warped rail against a flat surface plate using a body hammer or soft-faced mallet. [D] Aluminum is relatively malleable and can be cold-worked back to flat if the distortion is minor. Using a thicker gasket or excessive RTV does not address the root cause and invites future leaks. Replacing the pan for minor warpage is unnecessarily expensive when straightening is a viable repair.

21. A — On an OHV engine, a slight steady tick from a specific rocker arm that appeared after 1,000 miles of operation should first be investigated at the valve lash adjustment. [B] On engines with adjustable rocker arms, the adjustment can drift slightly during break-in as components seat and wear into their initial running clearances. Checking and readjusting the valve lash to specification is the simplest, least invasive first step and resolves the majority of post-rebuild valvetrain tick complaints without requiring component removal.

22. B — When a cylinder head is resurfaced to remove 0.005 inches of warpage, the head moves 0.005 inches closer to the block deck — and therefore 0.005 inches closer to the piston crowns at TDC. [B] On interference engines or engines with tight piston-to-valve clearance, this reduced distance must be verified to ensure the valves will not contact the pistons during the overlap period when both valves are partially open near TDC. On OHC engines, the changed head-to-block relationship also affects cam timing slightly, which may need verification.

23. D — Oil consumption of 3/4 quart per 1,000 miles is less than the manufacturer's published allowable threshold of one quart per 1,000 miles. [A] The consumption rate falls within the manufacturer's stated normal operating parameters for this engine. The technician should inform the

customer that while some oil consumption is occurring, it is within the range the manufacturer considers acceptable and does not indicate a defect requiring repair.

24. C — A rhythmic slapping noise from the timing belt cover area that is constant at all temperatures and speeds, on a belt replaced 5,000 miles ago, points to improper tensioner adjustment leaving excessive slack in the belt. [B] A properly tensioned belt runs quietly. When the tensioner is not adjusted correctly — either the automatic tensioner was not properly released or a manual tensioner was set too loose — the belt develops enough slack to slap against the inside of the cover or flap between the sprockets, producing the audible noise at all operating conditions.

25. A — Technician B only is correct: residual honing grit left in the crosshatch valleys acts as an aggressive abrasive compound that accelerates wear on both the new piston rings and the cylinder bore surface during break-in. [C] Technician A is wrong because solvent alone does not remove honing grit — the microscopic abrasive particles become trapped in the crosshatch valleys and are not dissolved or flushed by solvent. The correct cleaning method is hot soapy water with a stiff brush scrubbed through each bore until a white cloth comes away completely clean.

26. B — A starter that engages (solenoid clicks) and draws over 400 amps but cannot rotate the crankshaft — on a vehicle whose engine stopped suddenly at highway speed — indicates the engine has seized internally. [E] The extremely high current draw confirms the starter is trying to turn the crankshaft with maximum effort, but the mechanical resistance from the seized engine exceeds the starter's torque capacity. Common causes of sudden seizure include catastrophic bearing failure, a broken connecting rod jamming the crankcase, or a hydrostatic lock from coolant flooding a cylinder.

27. D — The oil pickup screen must be positioned 1/4 to 3/8 inch from the pan floor to remain submerged under all driving conditions. [D] At 3/4 inch — roughly double the maximum specification — the screen sits high enough above the oil surface that during hard cornering, braking, or acceleration, the oil sloshes away from the elevated pickup screen, exposing it to air. The pump draws air instead of oil, oil pressure drops instantly, and bearings are momentarily starved. This is particularly dangerous during aggressive driving.

28. C — Fluorescence found on the ground under the water pump area but on the side away from the weep hole indicates the coolant is not coming from the pump shaft seal (which exits at the weep hole) but from the gasket surface where the pump housing meets the block. [D] A water pump gasket leak allows coolant to seep at the mating surface under system pressure. The UV dye confirmed the exact leak location that was too small to detect during a static visual inspection. Replacing the water pump gasket — or the pump and gasket together — resolves the leak.

29. A — The journal is currently 0.012 inches below standard, and the scoring requires grinding to clean metal beyond the damaged layer. [C] Grinding to 0.020-inch undersize removes 0.020 inches from the original standard diameter — leaving 0.008 inches of fresh material beyond the current worn surface to clean up the scoring. The 0.030-inch undersize maximum provides a fallback if 0.020 is insufficient. Matching 0.020-inch undersize bearings restore proper clearance. The key principle is grinding to the smallest undersize that completely removes the damage.

30. B — A vacuum gauge fluctuation that dips rhythmically at a rate of once per two crankshaft revolutions corresponds to the firing frequency of a single cylinder on a four-stroke engine — each cylinder fires once every two crankshaft revolutions. [A] This pattern is the signature of a single cylinder with a burned valve. Each time the affected cylinder reaches its compression or power stroke, the leaking valve allows pressure to escape, producing a momentary vacuum dip. At higher RPM, the dips occur too rapidly for the gauge needle to follow individually.

31. D — Neither technician is entirely correct as stated because the anti-seize question depends on the specific spark plug manufacturer's recommendation, which varies. [E] Some spark plug manufacturers explicitly advise against anti-seize on their plugs (particularly on nickel-plated threads) because the reduced friction can lead to over-torquing at the specified torque value. Others permit or recommend it. The correct practice is always to follow the plug manufacturer's specific instruction for the plug being installed, which may differ between brands and designs.

32. C — All four cylinders are below the manufacturer's minimum specification (132–140 versus 145 minimum), confirming the engine is worn beyond its designed operating range. [A] However, all cylinders are within 10% of each other, indicating the wear is uniform — no single catastrophic failure exists. The engine is still running and functional. The honest assessment is that the engine is significantly worn and the customer should understand that performance, fuel economy, and oil consumption will continue to decline. The decision to rebuild is a cost-benefit judgment the customer makes based on this information.

33. B — Fine, shallow surface cracks radiating from the cylinder bore edge toward the bolt holes on the deck surface are thermal fatigue cracks — stress fractures caused by repeated heating and cooling cycles concentrated at the interface between the hot combustion chamber area and the cooler surrounding block material. [C] These cracks develop over high mileage from the thermal cycling stress that the deck surface endures with every heat cycle. If they are confirmed as surface-only and do not penetrate to coolant or oil passages, they may be acceptable — but the block should be closely monitored.

34. A — After installing a new water pump and timing belt with the tensioner adjusted per specification, slightly less belt tension than expected suggests the new pump's pulley geometry differs slightly from

the original. [B] Even a small difference in pulley diameter, offset, or bearing preload changes the belt's effective path length and the tension required. The technician should verify the new pump's part number matches the exact application and compare the pulley dimensions to the original pump. An aftermarket pump with a slightly different pulley specification is a common source of this issue.

35. D — A metallic rattle from the top of the engine that occurs only during the brief throttle-closing deceleration transition is consistent with a VVT cam phaser that momentarily loses stable oil pressure during the rapid change from loaded to unloaded operation. [A] When the throttle snaps closed, the sudden change in manifold vacuum and oil demand can cause a momentary oil pressure fluctuation at the phaser. The phaser's internal chambers momentarily lose hydraulic lock, allowing the internal vanes to rattle briefly before oil pressure re-stabilizes at the new idle condition.

36. C — When one bank has bores exceeding specification while the other bank is within specification, all eight cylinders should be bored to the same oversize to maintain uniform displacement and piston weight across the engine. [C] Mixing standard-bore cylinders with oversize-bore cylinders creates a displacement imbalance — the oversize cylinders have a slightly larger swept volume and produce marginally different compression pressures, which can cause vibration and uneven power delivery. Boring all eight to the same oversize with matched pistons maintains engine balance.

37. A — A P0172 (system too rich) code with negative fuel trim (PCM reducing fuel) on bank 1 only, with normal mechanical tests, indicates an excess fuel source on that bank. [E] A leaking fuel injector on bank 1 that delivers more fuel than the PCM commands enriches the mixture beyond the PCM's ability to correct through fuel trim alone. A vacuum leak would cause a lean code (P0171), not a rich code. A clogged air filter would affect both banks equally. A failed O2 sensor reading falsely lean would cause the PCM to add fuel, resulting in positive fuel trim, not negative.

38. B — A pushrod that measures 0.050 inches shorter than identical pushrods of the same part number has been physically shortened by compressive force. [C] The most likely cause is that the pushrod was repeatedly hammered between the rocker arm and the lifter due to excessive valve lash at the number 5 exhaust position. Over time, the repeated impact forces compressed and slightly deformed the pushrod ends, shortening it measurably. The excessive lash that caused the shortening must also be investigated — it may indicate a worn cam lobe or collapsed lifter.

39. C — Both oil pressure readings — 20 PSI at idle and 45 PSI at 2,500 RPM — fall within the manufacturer's specifications of 15 PSI minimum at idle and 40–65 PSI at cruise. [D] The readings are lower than when the vehicle was new because bearing clearances gradually increase with normal wear over the engine's service life, allowing slightly more oil to leak past each bearing and reducing measured

system pressure. This is expected aging behavior, not a failure. The customer should be reassured that the engine is operating within its designed parameters.

40. D — On an interference engine with the timing belt removed, the camshaft is no longer synchronized with the crankshaft. [A] If a valve was left in the open position when the belt was removed (or if the camshaft shifted position during belt removal), rotating the crankshaft can drive a piston into the open valve. The resistance felt on the breaker bar is the piston contacting the valve. The technician must not force the crankshaft — instead, the camshaft must be rotated to close the valves before the crankshaft can be safely positioned.

41. B — A cold-start knocking noise from the mid-block area that disappears when the engine warms up is the classic presentation of piston slap. [C] When the engine is cold, the aluminum pistons have not yet expanded to fill the bore, and if one or more pistons have slightly excessive clearance — even within the upper range of specification — they rock in the bore and slap the cylinder wall during each direction change. As the pistons heat and expand, the clearance tightens and the noise disappears.

42. A — Gradual power loss over 20,000 miles with uniformly low compression (120–128 versus 148–168 specification), reduced vacuum (15 in. Hg), decreased fuel economy, and no acute symptoms is the pattern of progressive generalized ring and bore wear. [A] The wear accumulates slowly over tens of thousands of miles, reducing each cylinder's ability to seal and produce power. The uniform nature of the compression loss confirms the wear is distributed across all cylinders rather than concentrated in one. This is normal engine aging that eventually necessitates an overhaul.

43. A — A thermostat rated at 195°F should begin opening at approximately 195°F — not 185°F. [D] Opening 10 degrees below the rated temperature means the thermostat is allowing coolant to flow to the radiator prematurely, which causes the engine to run cooler than its designed operating temperature. This reduces fuel economy, increases emissions, delays heater warm-up, and may trigger a P0128 (thermostat below regulating temperature) code. The thermostat should be replaced with one that opens at the correct rated temperature.

44. D — The junction where the oil pan gasket meets the rear main seal housing is one of the most leak-prone areas on any engine because three sealing surfaces converge — the pan, the block, and the rear seal housing. [D] Most manufacturers require a specific sealant application at this junction point during assembly. If the sealant was omitted, applied incorrectly, or if an insufficient amount was used, the three-surface intersection will not seal and oil weeps from the joint. The correct repair is to reseal the junction with the manufacturer-specified sealant type and application method.

45. C — An entire bank of cylinders showing uniformly low compression with wet test improvement (confirming ring wear) while the opposite bank is within specification indicates a systemic factor affecting one bank more than the other. [C] Engine design factors — such as uneven coolant distribution (one bank runs hotter), asymmetric oil delivery (one bank receives less oil to the bore walls), or exhaust layout differences — can cause one bank to wear faster than the other over high mileage. This is a recognized wear pattern on certain V-configuration engines.

46. A — Technician A only is correct: the proper removal method for a harmonic balancer is a three-jaw puller or a dedicated balancer puller designed for the application. [C] Technician B is wrong because hammering on the end of the crankshaft transmits shock loads through the entire crankshaft, potentially damaging the thrust bearing, main bearings, and crankshaft snout threads. The impact force can also damage the crankshaft's internal oil passages and the pilot bearing or bushing at the rear of the crankshaft.

47. B — One quart per 300 miles with visible blue haze on a freshly rebuilt engine during the first 500 miles suggests the piston rings have not adequately seated against the bore surface. [C] The most common cause of failed ring seating is an inadequate break-in procedure — specifically, sustained idle or light-load driving that does not generate enough cylinder pressure to force the rings firmly against the bore. The rings need moderate-to-heavy cylinder pressures from varied-RPM driving to initiate the controlled micro-wear process that conforms the ring face to the bore surface.

48. D — Oil contamination on the flywheel friction surface is most commonly caused by a leaking rear main crankshaft seal, which is located directly behind the flywheel. [D] The rear main seal is the last seal on the crankshaft before the flywheel, and any oil that passes the seal drips directly onto the flywheel surface. The blue-black discoloration and glazing on the friction surface are caused by the clutch disc slipping on the oil-contaminated surface, generating heat that discolors and hardens the flywheel. The rear main seal must be replaced along with the clutch components.

49. B — A temperature gauge that rhythmically rises and falls in a repeating 30-second cycle during highway driving with correct coolant level and a system that holds pressure is most consistent with a trapped air pocket circulating through the system. [D] As the air pocket passes the temperature sensor, the sensor reads a spike (air is a poor heat conductor and the sensor surface heats up momentarily). When liquid coolant replaces the air at the sensor, the reading drops back to normal. The cycle repeats as the air pocket circulates through the cooling loop. Bleeding the system removes the trapped air and stabilizes the gauge.

50. C — A very faint sweet smell from the exhaust with all other tests negative represents an ambiguous finding that warrants monitoring rather than immediate action or dismissal. [A] The negative block test,

stable coolant level, and clean oil are all favorable indicators. However, a faint sweet smell could represent a very minor coolant intrusion below the detection threshold of the block test. The appropriate response is to document the finding, instruct the customer to monitor the coolant level, and schedule a recheck in 500 miles. If the coolant level drops or other symptoms develop, further investigation is warranted.