PRACTICE EXAM 5: ASE A1 ENGINE REPAIR SIMULATION (50 QUESTIONS)

1. A technician is diagnosing an engine with a rough idle complaint. A scan tool shows long-term fuel trim at +22% on bank 1 and +3% on bank 2. A vacuum gauge reads a steady 17 in. Hg at idle. The engine has 145,000 miles. Which of the following is the MOST likely cause of the elevated bank 1 fuel trim?

A. Worn piston rings on multiple bank 1 cylinders reducing compression uniformly

B. A vacuum leak on bank 1 that is introducing unmetered air into the intake manifold

C. A failing fuel pump that cannot deliver adequate fuel volume to bank 1 injectors

D. A restricted exhaust on bank 1 causing back-pressure and reducing cylinder filling

2. All of the following could cause an engine to overheat at idle but maintain normal temperature at highway speed EXCEPT:

A. A failed electric cooling fan motor that does not spin when commanded on

B. A cooling fan relay that has an open circuit preventing current to the fan motor

C. A thermostat that is stuck in the fully closed position blocking all radiator flow

D. A cooling fan temperature sensor that reads lower than the actual coolant temperature

3. A customer brings in a vehicle stating that the engine has been making a tapping noise for two weeks. The technician discovers the engine is three quarts low on oil. After adding oil to the correct level, the tapping noise disappears within 30 seconds. Which of the following BEST explains why the noise stopped?

A. The additional oil cooled the overheating valvetrain components and reduced expansion

B. The higher oil level submerged the crankshaft counterweights and dampened vibration

C. The added oil restored pressure to the rod bearings and eliminated bearing knock

D. The restored oil level allowed the hydraulic lifters to pump up and achieve zero lash

4. Technician A says that the compression ratio of an engine is increased when the cylinder head is resurfaced beyond the manufacturer's specification. Technician B says that excessive head resurfacing on an OHC engine can advance the camshaft timing relative to the crankshaft. 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

5. A vehicle with a 4-cylinder turbocharged GDI engine has 85,000 miles and is experiencing a rough idle and misfire on cylinder 2 that occurs only during cold start and clears after approximately 90 seconds of warm-up. Compression readings on all cylinders are within 5% of each other and meet specification. Which of the following is the MOST likely cause?

A. A worn exhaust cam lobe on cylinder 2 that does not fully open the valve when cold

B. A weak valve spring on cylinder 2 that allows the valve to float only during cold idle

C. A failed ignition coil on cylinder 2 that functions intermittently until fully warmed up

D. Carbon buildup on the back of the intake valve on cylinder 2 disrupting fuel atomization

6. A technician is replacing a rear main seal on an engine and discovers a deep groove worn into the crankshaft sealing surface by the old seal. A new seal installed in the same location will ride in this groove and leak. Which of the following is the correct repair?

A. Apply a bead of RTV sealant around the new seal lip to fill the groove and prevent leaks

B. Install a crankshaft repair sleeve over the sealing surface to provide a smooth new surface

C. Offset the new seal position slightly forward or backward to avoid the worn groove area

D. Replace the crankshaft because the groove cannot be repaired with any available method

7. A technician performs a leak-down test on cylinder 5 of a V8 engine. The supply gauge reads 100 PSI and the cylinder gauge reads 70 PSI. What is the leakage percentage, and what condition does this level of leakage indicate?

A. 30% leakage, indicating excessive leakage that requires identifying the source and repair

B. 70% leakage, indicating a catastrophic failure that requires immediate engine disassembly

C. 30% leakage, indicating a normal amount of leakage for a high-mileage operating engine

D. 70% leakage, indicating the leak-down tester is malfunctioning and must be recalibrated

8. A vehicle owner reports that the engine oil turns dark brown within 500 miles of an oil change. The oil level remains stable, the engine does not smoke, and performance is normal. Which of the following BEST explains this condition?

A. The engine has an internal coolant leak that is contaminating the oil with antifreeze

B. The oil filter is defective and allowing unfiltered oil to circulate through the engine

C. The rapid darkening is normal because oil absorbs combustion byproducts during operation

D. The engine has excessive blowby that is forcing combustion gases into the crankcase oil

9. Technician A says that the oil pump should never be tested by priming it with engine oil and spinning it with a drill before installation. Technician B says that the oil pump should be packed with petroleum jelly before installation to prevent a dry start. 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

10. A freshly rebuilt engine develops a rod bearing knock within the first 200 miles of operation. The technician had verified all bearing clearances with Plastigage during assembly and all were within specification. The engine was pre-lubricated before first start and oil pressure was verified immediately. Which of the following is the MOST likely cause of the premature bearing failure?

A. The assembly lubricant used was incompatible with the engine oil and broke down

B. Contamination from inadequate oil gallery cleaning embedded in the bearing surface

C. The Plastigage strips were read incorrectly, resulting in actual clearances being wrong

D. The new bearing shells were defective from the manufacturer with incorrect dimensions

11. A V6 engine has a persistent P0306 (cylinder 6 misfire) code. The ignition coil and spark plug have been replaced. The fuel injector has been tested and confirmed functional. A compression test shows cylinder 6 at 140 PSI while all other cylinders are between 148 and 155 PSI. The compression reading is below the manufacturer's minimum specification of 145 PSI but within 10% of the highest cylinder. Which of the following is the correct interpretation?

A. Cylinder 6 compression is acceptable because it is within 10% of the other cylinders

B. The P0306 misfire is caused by the low compression on cylinder 6 below minimum spec

C. The misfire has a non-mechanical cause because the readings are close to each other

D. Cylinder 6 is below the manufacturer's minimum specification and requires further investigation

12. A technician is using a smoke machine to check for intake system leaks on an engine with a rough idle complaint. Smoke is observed seeping from around the oil filler cap and the dipstick tube. Which of the following BEST explains this finding?

A. The crankcase ventilation system is drawing smoke from the intake through the PCV circuit

B. The oil filler cap seal and the dipstick tube seal are both leaking simultaneously as sources

C. The PCV system connects the crankcase to the intake, so smoke flowing backward is normal

D. The engine has a cracked block that is allowing intake manifold vacuum into the crankcase

13. Technician A says that a cylinder ridge must be removed before pulling pistons out of the bore during engine disassembly. Technician B says that the ridge does not need to be removed if the cylinders will be bored to the next oversize. 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

14. A technician is diagnosing a slight coolant loss on a vehicle with no visible external leaks. The engine oil is clean. A cooling system pressure test holds for 20 minutes. A block test is negative. The customer reports a slightly sweet smell from the HVAC vents when the blower is on high. Which of the following is the MOST likely cause?

A. A heater core with a small internal leak that is releasing coolant vapor into the cabin

B. A head gasket breach so small that it only leaks under driving load and heat conditions

C. A cracked intake manifold allowing coolant to seep into the intake port and evaporate

D. A deteriorating coolant hose behind the engine that drips only when the vehicle is moving

15. An engine has been sitting unused for eight months in a humid climate. On the first start attempt, the engine cranks but will not fire. A compression test shows erratic readings between 40 and 110 PSI across all cylinders with no consistent pattern. After cranking the engine for 30 additional seconds, the readings improve to 125 to 135 PSI across all cylinders. Which of the following BEST explains the initial low and erratic readings?

A. The timing chain stretched during storage and required cranking to reseat on the sprockets

B. The piston rings stuck in their grooves during storage and required cranking to free them

C. The valve stem seals hardened during storage and restricted valve movement temporarily

D. The engine oil drained from the galleries during storage and bearings were momentarily dry

16. A technician is reassembling a cylinder head and discovers that the valve spring installed height on the number 3 intake valve is 0.040 inches greater than specification after the valve and seat were reconditioned. Which of the following is the MOST appropriate correction?

A. Install a thicker valve stem seal to reduce the effective height of the spring assembly

B. Install a 0.040-inch shim under the valve spring to restore the correct installed height

C. Replace the valve spring with a longer one that provides the correct pressure at height

D. Grind 0.040 inches from the valve stem tip to shorten the valve and reduce the height

17. A customer reports that the engine temperature gauge reads normal during city driving but drops below the normal range during sustained highway driving in winter temperatures below 20°F. The heater output is slightly reduced during highway driving compared to city driving. Which of the following is the MOST likely cause?

A. A water pump that is circulating coolant too rapidly at highway engine RPM speeds

B. A cracked radiator tank that allows cold air to enter the cooling system on the highway

C. A thermostat that is opening slightly below its rated temperature specification

D. A missing or damaged air dam below the front bumper exposing the radiator to cold air

18. Technician A says that blue threadlocker should be used on cylinder head bolts to prevent them from loosening during engine operation. Technician B says that engine oil should be applied to head bolt threads and under the bolt head before torquing unless the manufacturer specifies otherwise. 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

19. A technician is performing a relative compression test using a current clamp on the battery cable during cranking. The oscilloscope waveform shows that the current spike for cylinder 3 is significantly lower in amplitude than the spikes for all other cylinders. Which of the following does this indicate?

A. Cylinder 3 has higher-than-normal compression requiring more current to compress

B. The starter motor has a dead spot that coincides with the cylinder 3 compression stroke

C. Cylinder 3 has an electrical problem that is drawing less current from the starter circuit

D. Cylinder 3 has lower compression than the other cylinders and offers less cranking resistance

20. A technician discovers that the harmonic balancer on an engine has its outer ring shifted approximately 1/4 inch from its original position relative to the inner hub. The rubber bonding material between the hub and ring is visibly deteriorated. All of the following are consequences of this condition EXCEPT:

A. The timing mark on the outer ring no longer accurately represents crankshaft position

B. Torsional vibrations are no longer being absorbed and may cause crankshaft fatigue

C. The serpentine belt may track unevenly across the crankshaft pulley due to misalignment

D. The engine will develop low oil pressure because the balancer drives the oil pump gear

21. A vehicle with a DOHC engine is brought in for a noise complaint. The technician identifies a metallic rattling noise from the front of the engine at startup that lasts about four seconds. A scan tool shows no stored codes. Oil level and condition are normal. The vehicle has 110,000 miles, and oil changes have been performed every 7,500 miles with the manufacturer-recommended full synthetic oil. Which of the following is the MOST likely cause?

A. A worn VVT cam phaser that drains oil during shutdown and rattles until refilled

B. A loose timing chain guide that vibrates until oil pressure stabilizes the tensioner

C. A failing water pump bearing that makes noise until thermal expansion closes the gap

D. A deteriorating accessory drive belt tensioner that bounces until it reaches full tension

22. During a rebuild, a technician measures a piston skirt diameter and the corresponding cylinder bore diameter. The bore measures 3.5010 inches and the piston measures 3.4985 inches. The manufacturer's piston-to-bore clearance specification is 0.0010 to 0.0020 inches. Which of the following is the correct assessment?

A. The clearance of 0.0025 inches is within specification and no correction is needed

B. The clearance is too tight and will cause piston scuffing when the engine reaches temperature

C. The clearance of 0.0025 inches exceeds specification and may cause piston slap and blowby

D. The bore must be honed to a larger diameter to bring the clearance within specification

23. A technician performs a block test on a vehicle with a suspected head gasket failure. On the first attempt, the test fluid does not change color. The technician runs the engine at 2,500 RPM under load for five minutes and repeats the test. This time, the fluid changes color. Which of the following BEST explains why the second test was positive when the first was negative?

A. The test fluid was contaminated during the first test and gave an inaccurate result reading

B. Higher RPM and load increased cylinder pressure, forcing more combustion gas into the coolant

C. The engine coolant temperature was too low during the first test for the fluid to react properly

D. The head gasket failure expanded during the five minutes of running under load and heat

24. All of the following are functions of engine oil EXCEPT:

A. Absorbing heat from internal components and carrying it to the oil pan for dissipation

B. Sealing the microscopic gap between piston rings and the cylinder bore wall surface

C. Suspending contaminants and combustion byproducts to be captured by the oil filter

D. Raising the boiling point of the engine coolant by reducing friction-generated heat output

25. A technician is evaluating whether a crankshaft can be reused or needs regrinding. The main journal standard specification is 2.6380 to 2.6390 inches. The technician's measurements show the journal at 2.6365 inches in all four measurement positions. The journal surface is smooth with no scoring or discoloration. Which of the following is the correct decision?

A. Reuse the journal as-is because the surface condition is excellent and within tolerance

B. Polish the journal and install standard bearings because the wear is only 0.0015 inches

C. The journal is below the standard minimum and must be reground to the next undersize

D. Install 0.001-inch undersize bearings on the standard journal to compensate for the wear

26. A customer reports that the engine makes a deep thudding noise from the bottom of the engine at idle. The technician performs a cylinder-disable test by unplugging injectors one at a time. The noise does not change regardless of which cylinder is disabled. Which of the following types of bearing failure does this pattern suggest?

A. Worn main bearings rather than connecting rod bearings based on the disable test result

B. A worn connecting rod bearing on a cylinder the technician failed to properly disable

C. The noise is not bearing-related and is caused by a loose or cracked flywheel or flexplate

D. A worn thrust bearing that produces the noise only under axial crankshaft loading forces

27. A technician is testing a radiator cap and finds that it releases at 11 PSI. The cap is rated at 16 PSI. The customer has been adding coolant weekly to the overflow reservoir. Which of the following BEST explains how the weak cap is contributing to coolant loss?

A. The weak cap is creating a vacuum in the system that pulls coolant past the water pump seal

B. The cap opens prematurely at normal operating pressure, venting coolant to the overflow tank

C. The low release pressure is causing the water pump to cavitate and push coolant out externally

D. The weak cap allows the thermostat to open earlier than designed, overcooling the engine

28. Technician A says that when installing a head gasket on a block with alignment dowel pins, the gasket should be placed over the dowels before the head is lowered into position. Technician B says that head gaskets marked with "TOP" or "THIS SIDE UP" must be installed with the marked side facing the cylinder head. Who is correct?

A. Technician A only

B. Neither Technician A nor Technician B

C. Technician B only

D. Both Technician A and Technician B

29. A technician is diagnosing a vehicle that cranks slowly in cold weather. The battery passes a load test and the starter motor current draw is within specification. A voltage drop test on the positive starter cable reads 0.15 volts during cranking, and the ground circuit reads 0.10 volts during cranking. Both readings are within specification. Which of the following is the MOST likely cause of the slow cranking?

A. An internally worn starter motor with high brush-to-commutator resistance when cold

B. A parasitic draw that partially discharges the battery overnight in cold temperatures

C. The engine oil viscosity is too high for the ambient temperature, increasing cranking resistance

D. A faulty ignition switch that delivers reduced voltage to the starter solenoid circuit

30. A technician notices that one cylinder head bolt on a torque-to-yield application is approximately 1/2 inch shorter than the specification for that bolt hole. The bolt was sourced from the original set removed during disassembly and was labeled with its position. Which of the following is the MOST likely explanation?

A. The bolt has been permanently stretched beyond its design length from the previous installation

B. The bolt hole in the block is deeper than the others due to a manufacturing variation

C. The bolt was installed in the wrong location during the previous assembly and did not bottom out

D. The bolt is the correct length and was simply mismarked during the disassembly process

31. A four-cylinder engine has the following compression test results: Cyl 1 = 165 PSI, Cyl 2 = 170 PSI, Cyl 3 = 168 PSI, Cyl 4 = 160 PSI. The manufacturer's specification is 145 to 175 PSI with a maximum variation of 10% between the highest and lowest cylinders. The highest reading is 170 PSI. 10% of 170 is 17. The lowest acceptable reading is 153 PSI. All cylinders meet the specification. However, the engine has a persistent rough idle. Which of the following is the correct conclusion?

A. The rough idle is unlikely to be caused by an engine mechanical problem based on these readings

B. The compression readings are too high and indicate excessive carbon buildup in all combustion chambers

C. Cylinder 4 is the likely cause of the rough idle because it has the lowest reading of the four

D. The engine should be disassembled for inspection despite the acceptable compression results

32. A technician discovers that the engine block deck surface has a scratch approximately 0.003 inches deep running diagonally across the surface between two cylinders. The scratch was caused by a gasket scraper during cleaning. The engine uses an MLS head gasket. Which of the following is the correct action?

A. Fill the scratch with a thin layer of anaerobic sealant before installing the head gasket

B. Lightly sand the area around the scratch to feather the edges and install the gasket

C. Install the MLS gasket as-is because the scratch is too shallow to cause a sealing problem

D. Resurface the block deck to remove the scratch before installing the MLS head gasket

33. A vehicle has been driven 50 miles since a timing belt replacement. The customer returns with a complaint that the engine feels noticeably less powerful than before the service and fuel economy has dropped. The engine runs without misfires and has no warning lights. A compression test shows all four cylinders between 105 and 110 PSI. The specification is 145 to 165 PSI. Which of the following is the MOST likely cause?

A. The camshaft timing is off by one tooth, retarding valve timing on all cylinders uniformly

B. The new timing belt is defective and stretching under load, allowing timing to drift

C. The fuel injectors were contaminated during the timing belt service and are underdelivering

D. The spark plug gap widened during the timing belt service from accidental contact

34. A technician is inspecting a flywheel removed during a clutch replacement and notices a network of fine heat cracks (heat checking) across the friction surface. The cracks do not extend through the full thickness of the flywheel. Which of the following is the correct action?

A. Replace the flywheel immediately because any heat cracking indicates structural failure

B. Weld-repair the cracks and resurface the flywheel before reinstalling it on the engine

C. Resurface the flywheel to remove the heat-checked layer and restore a smooth surface

D. Reinstall the flywheel as-is because superficial heat checking is common and cosmetic

35. A customer reports that after an oil change, the engine started making a loud ticking noise from the top of the engine that was not present before the oil change. The technician verifies that the oil level is at the full mark and the correct oil viscosity was used. Which of the following should the technician check FIRST?

A. The valve lash settings to determine if the rocker arms were disturbed during the change

B. The oil filter to verify that it is the correct application and is not restricting oil flow

C. The timing chain tensioner for a hydraulic failure caused by the oil pressure interruption

D. The cylinder head for a crack that opened when the engine cooled during the oil change

36. A technician is performing a cylinder bore measurement on a six-cylinder engine. The measurement taken at the top of ring travel perpendicular to the crankshaft on cylinder 4 reads 3.7830 inches. The measurement at the same height parallel to the crankshaft reads 3.7812 inches. The maximum out-of-round specification is 0.0015 inches. Which of the following is the correct conclusion?

A. The out-of-round is 0.0018 inches, which is within the specified tolerance for this engine

B. The out-of-round is 0.0018 inches, which is acceptable with new rings and a light hone

C. The measurement technique is incorrect because out-of-round is measured at the bottom only

D. The out-of-round is 0.0018 inches, which exceeds specification and requires boring

37. Technician A says that the fresh air inlet hose of the PCV system should be connected to the clean side of the air filter housing. Technician B says that if the fresh air inlet hose is disconnected, unfiltered air will enter the crankcase and contaminate the engine oil. 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

38. Technician A says that engine coolant should be a 50/50 mixture of antifreeze and water for most climates. Technician B says that using straight antifreeze without water provides the best freeze protection for extremely cold climates. Who is correct?

A. Technician A only

B. Technician B only

C. Both Technician A and Technician B

D. Neither Technician A nor Technician B

39. A four-cylinder engine with a single overhead cam has the following compression readings: Cyl 1 = 150 PSI, Cyl 2 = 155 PSI, Cyl 3 = 50 PSI, Cyl 4 = 148 PSI. A wet test on cylinder 3 raises the reading to 55 PSI. A leak-down test on cylinder 3 shows 48% leakage. Air is heard simultaneously at both the intake opening and the exhaust tailpipe. Which of the following conditions could produce air leaking from both locations at the same time?

A. Both the intake and exhaust valves on cylinder 3 are burned or damaged simultaneously

B. A massive head gasket failure has breached both the intake and exhaust ports on cylinder 3

C. The camshaft timing has jumped so that both valves are partially open at TDC compression

D. The piston on cylinder 3 has a hole that allows air to reach both valves from the crankcase

40. A technician is diagnosing a V8 engine with a high-pitched whining noise that increases with engine RPM. The noise is present at all temperatures and load conditions. Using a stethoscope, the noise is loudest at the front of the engine near the timing cover and oil pump area. Which of the following is the MOST likely cause?

A. A worn timing chain rubbing against the inside of the timing cover at high speed

B. A faulty serpentine belt idler pulley bearing that is beginning to disintegrate

C. An exhaust manifold leak at the rear of the engine reflecting sound to the front

D. A worn oil pump with excessive internal clearances producing cavitation whine

41. A technician measures the free height of a set of valve springs during a cylinder head rebuild. One spring measures 1.85 inches while the specification is 1.90 to 1.95 inches. All other springs measure between 1.91 and 1.94 inches. Which of the following is the correct action for the short spring?

A. Replace the short spring because it is below the minimum free height specification

B. Install the spring with a 0.050-inch shim to compensate for the reduced free height

C. Retest the spring under pressure load to determine if it still meets the tension specification

D. Install the spring as-is because the 0.050-inch difference is within acceptable variance

42. A technician performs a cooling system pressure test. The system holds pressure for the full 20-minute test with no drop. However, the customer continues to report intermittent overheating episodes during heavy traffic on hot days. Which of the following should the technician investigate NEXT?

A. A head gasket breach that only opens under the high cylinder pressures of heavy load

B. A water pump impeller that has separated from the shaft and is not circulating coolant

C. The cooling fan operation, relay, temperature sensor, and fan motor under actual conditions

D. A thermostat that is stuck partially open and limiting coolant flow through the radiator

43. A technician is rebuilding an engine and discovers that the number 2 main bearing cap does not fit tightly in its saddle — it can be rocked slightly by hand before the bolts are installed. All other caps fit snugly. Which of the following is the MOST likely cause?

A. The number 2 cap bolts are stretched and no longer pulling the cap into the saddle

B. The mating surfaces between the cap and block have fretting damage causing a poor fit

C. The cap was accidentally swapped with a cap from another position during disassembly

D. The main bearing shell is the wrong thickness and is holding the cap away from the block

44. An engine has been diagnosed with worn valve guides on the exhaust side of all four cylinders. The customer wants to minimize cost. The intake valve guides are within specification. Which of the following repair approaches is MOST appropriate?

A. Replace or repair only the worn exhaust valve guides and install new exhaust valve stem seals

B. Replace all eight valve guides (intake and exhaust) because they wear as matched sets

C. Install oversize valve stems on the exhaust valves and ream the existing guides to match

D. Install new valve stem seals on the exhaust valves only without repairing the guides

45. A technician observes that an engine produces a brief cloud of black smoke from the exhaust when the throttle is quickly opened from idle, but the engine runs cleanly during normal steady-state operation. Which of the following is the MOST likely cause?

A. A leaking fuel injector on one cylinder that dumps fuel during the pressure spike of throttle opening

B. A restricted air filter that cannot supply adequate air volume during the rapid demand of acceleration

C. Worn piston rings that allow oil into the combustion chambers during rapid throttle transitions

D. A momentary rich condition from the accelerator pump or transient fuel enrichment strategy

46. A technician is preparing to remove the cylinder heads from a V6 engine for head gasket service. Which of the following steps should be performed FIRST before any disassembly begins?

A. Drain the engine oil to prevent coolant from contaminating the oil during head removal

B. Remove the intake manifold to gain access to the cylinder head bolts on both banks

C. Relieve the fuel system pressure and disconnect the negative battery cable for safety

D. Remove the exhaust manifolds from both banks to free the heads for vertical removal

47. A rebuilt engine has been running for 3,000 miles with no problems. The customer returns stating that the oil pressure gauge now reads 5 PSI lower at idle than it did when the engine was new. The oil is at the correct level and was changed at 500 miles per instructions. Which of the following BEST explains this pressure decrease?

A. The oil pump is failing prematurely due to a manufacturing defect in the replacement unit

B. Normal bearing break-in wear has slightly increased clearances, allowing marginally more oil flow

C. The oil pressure sending unit has drifted in calibration and is reading lower than actual

D. The pressure relief valve spring has weakened from the heat cycling of 3,000 miles of use

48. A vehicle with a 4-cylinder engine has an intermittent check engine light that sets a P0302 code (cylinder 2 misfire). The misfire occurs only during the first two minutes of cold start and does not return once the engine is warm. Compression, coil, plug, and injector have been verified as functioning correctly. The engine has 160,000 miles. Which of the following is the MOST likely remaining cause?

A. A stretched timing chain that causes timing drift only when the chain is cold and contracted

B. A slightly burned exhaust valve on cylinder 2 that seals adequately once heat expansion closes the gap

C. A cracked engine block at cylinder 2 that opens when cold and closes as the block heats up

D. A worn camshaft lobe on cylinder 2 that only causes insufficient lift at cold idle speeds

49. All of the following are correct practices when performing an engine compression test EXCEPT:

A. Allowing the engine to reach operating temperature before beginning the test procedure

B. Removing all spark plugs from the engine before testing any individual cylinder

C. Holding the throttle plate in the wide-open position during the cranking test cycles

D. Testing each cylinder with only its own spark plug removed to isolate its compression

50. A technician is installing new connecting rod bearings during an engine rebuild. After torquing the number 3 rod cap to specification, the technician attempts to rotate the crankshaft and finds that it has become noticeably tighter — but still rotates — compared to before the number 3 cap was installed. Which of the following BEST explains this finding?

A. This is normal and expected because each additional rod assembly adds friction to the crank

B. The number 3 rod bearing clearance is at the loose end of specification and will loosen further

C. The number 3 rod cap bolts were over-torqued and have distorted the bearing bore slightly

D. The number 3 bearing clearance is too tight but still within a marginally acceptable range

Practice Exam *5*: 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 — A long-term fuel trim of +22% on one bank means the PCM is adding 22% more fuel than normal to compensate for a lean condition on that bank only. [A] The most common cause of a single-bank lean condition is a vacuum leak on that bank — unmetered air enters the intake manifold and dilutes the mixture, and the PCM responds by increasing injector pulse width. A failing fuel pump would affect both banks equally, and worn rings would not produce this level of fuel trim correction.

2. C — A thermostat stuck fully closed blocks all coolant flow to the radiator regardless of engine speed, causing overheating at both idle and highway speed — not just at idle. [D] All other choices describe conditions where the cooling fan does not operate when needed: a dead fan motor, an open relay circuit, or a sensor that never signals the fan to turn on. These conditions cause idle-only overheating because highway airflow through the radiator compensates for the absent fan. A stuck-closed thermostat is the exception because it blocks flow entirely.

3. D — The tapping noise from low oil level was caused by hydraulic lifters that could not maintain their oil charge because oil pressure was insufficient at the reduced volume. [A] When oil was added and the level restored, the pump was able to deliver adequate pressure to the lifters, they pumped up to establish zero lash, and the tapping ceased. This is the most common noise complaint associated with low oil level on engines equipped with hydraulic lifters.

4. A — Both technicians are correct. [B] Technician A is right because resurfacing removes material from the head deck, reducing combustion chamber volume and thereby increasing the compression ratio — potentially causing detonation on the recommended fuel grade. Technician B is also right because on OHC engines, moving the head closer to the block moves the camshaft closer to the crankshaft, which effectively advances the cam timing by a small amount and also changes timing chain tension.

5. D — A cold-start-only misfire that clears after 90 seconds on a GDI engine with normal compression is classic carbon buildup on the back of the intake valve. [A] In GDI engines, fuel is injected directly into the cylinder rather than onto the intake valve, so the valve is not washed clean by fuel spray. Carbon accumulates on the valve back over time and disrupts airflow and fuel atomization. The carbon's effect is worst during cold idle when fuel vaporization is already poor, and improves as heat softens the deposits and conditions stabilize.

6. B — A crankshaft repair sleeve is a precision-machined thin steel sleeve that is pressed over the worn seal journal surface, providing a new, smooth, unworn surface for the new seal lip to ride on. [D] RTV sealant applied to a seal lip would be immediately destroyed by the rotating shaft. Offsetting the seal is not a reliable engineered solution. Crankshaft replacement for a seal journal groove is unnecessarily expensive when a repair sleeve restores the surface effectively.

7. A — Leakage percentage equals (100 minus 70) divided by 100, which is 30%. [A] Any leakage above 20% is considered excessive and requires identification of the leak source — the technician must listen for air escaping at the tailpipe (exhaust valve), intake (intake valve), oil filler cap (rings), or coolant (head gasket). 30% leakage is not catastrophic but is well above the acceptable range and indicates a specific component failure requiring repair.

8. C — Engine oil darkening rapidly after an oil change is completely normal behavior. [A] One of oil's primary functions is to absorb and suspend combustion byproducts — carbon, soot, and acidic compounds — keeping them in suspension rather than allowing them to deposit on engine surfaces. This contamination causes the oil to turn dark brown or black. The rate of darkening depends on engine condition, fuel quality, and operating conditions, but a color change within 500 miles is not unusual and does not indicate a problem.

9. A — Technician B only is correct: packing the oil pump with petroleum jelly before installation eliminates the air pocket inside the pump that would otherwise prevent it from priming on the first engine start. [D] The petroleum jelly provides a temporary seal that allows the pump gears to create suction and begin drawing oil. Technician A is wrong — there is nothing harmful about bench-testing a pump by priming it with oil and spinning it with a drill; in fact, some manufacturers recommend verifying pump function before installation.

10. B — A rod bearing failure within 200 miles despite verified clearances and pre-lubrication points most strongly to contamination from inadequately cleaned oil galleries. [C] Residual honing grit, machining debris, or cleaning chemical residue that was not fully removed during block preparation was dislodged by fresh oil flow on first startup, carried to the bearing, and embedded in the soft bearing material, causing rapid scoring and failure. This is one of the most common causes of premature bearing failure in rebuilt engines.

11. D — While the cylinder 6 reading is within 10% of the highest cylinder, it falls below the manufacturer's absolute minimum specification of 145 PSI. [A] Both criteria must be met — within 10% of each other AND above the minimum specification. A reading of 140 PSI is below the 145 PSI minimum and warrants further investigation with a wet test and leak-down test to determine whether a valve, ring, or gasket issue is developing. The 10% rule identifies relative imbalance; the minimum spec identifies absolute insufficiency.

12. C — When smoke is introduced into the intake manifold during a smoke test, it naturally travels through all connected pathways — including the PCV hose that connects the intake manifold to the crankcase. [A] Smoke flowing from the intake manifold through the PCV circuit and appearing at the oil filler cap and dipstick tube is normal expected behavior, not an indication of a leak. The technician should look for smoke escaping at external gasket surfaces, not at crankcase openings that are connected to the intake by design.

13. B — Both technicians are correct. [C] Technician A is right that the ridge must be removed before pulling pistons if the cylinders will be reused at standard size — pulling a piston through the ridge snags the ring lands and can break the piston and rings. Technician B is also right that if the cylinders will be

bored to the next oversize, the boring process removes the ridge along with the rest of the worn bore material, making separate ridge removal unnecessary.

14. A — A sweet smell from the HVAC vents with no visible external leak, clean oil, a system that holds pressure, and a negative block test points to a small heater core leak that is releasing coolant vapor into the cabin air. [D] The heater core operates under system pressure with hot coolant flowing through it. A pinhole leak vaporizes the coolant before it can form visible liquid, producing the characteristic sweet antifreeze smell inside the cabin. This is often the earliest detectable symptom of a beginning heater core failure.

15. B — Erratic, low compression readings that improve dramatically after extended cranking on an engine that has sat for months in a humid climate is the classic presentation of stuck piston rings. [C] Moisture, varnish, and corrosion cause the rings to stick in their grooves during extended storage, preventing them from sealing against the bore. The cranking action, combined with oil circulation, works the rings free from their stuck positions, restoring their ability to seal and producing the improved compression readings on subsequent testing.

16. B — Installed height that exceeds specification by 0.040 inches is corrected by installing a 0.040-inch shim under the valve spring, which compresses the spring by exactly the excess amount and restores the correct closing force. [B] Installed height is the only valve spring measurement that can be corrected with a shim — free height, squareness, and spring pressure deficiencies require spring replacement. Grinding the valve stem tip would alter valve lash and is not a substitute for shimming.

17. C — A temperature gauge that drops below normal during sustained highway driving in very cold weather indicates the cooling system is removing heat faster than the engine produces it at cruise load. [D] The thermostat should prevent this by closing to restrict radiator flow when coolant temperature drops. A thermostat opening at a lower temperature than rated allows coolant to flow through the radiator prematurely, and the combination of high ram airflow and cold ambient temperatures overcools the engine at highway speed.

18. A — Technician B only is correct: head bolt threads and the underside of the bolt head should be lightly oiled before torquing unless the manufacturer specifies a different treatment. [B] Oil reduces the friction during tightening, ensuring that the torque reading on the wrench accurately reflects the clamping force being applied. Dry threads consume a significant portion of the applied torque as friction rather than clamping force, resulting in under-clamped head gaskets. Threadlocker should never be used on head bolts — it prevents proper torque-to-clamping-force conversion.

19. D — During cranking, each cylinder's compression stroke requires extra effort from the starter motor, producing a current spike. [A] A cylinder with low compression offers less resistance to the rising piston, so the starter motor draws less current during that cylinder's compression stroke, producing a shorter current spike on the oscilloscope waveform. This is the principle behind relative compression testing — the amplitude of current spikes reveals compression imbalances without removing spark plugs.

20. D — The harmonic balancer does not drive the oil pump — on most engines, the oil pump is driven by the crankshaft directly, by the distributor/intermediate shaft, or by the timing chain. [A] All other consequences are real: the shifted outer ring causes inaccurate timing marks (the timing mark is on the outer ring), the deteriorated rubber no longer dampens torsional vibrations (risking crankshaft fatigue), and the misaligned pulley surface can cause belt tracking problems.

21. A — A brief startup rattle from the front of a DOHC engine with VVT that lasts a few seconds and clears is the classic presentation of a cam phaser that has drained oil during shutdown. [B] When the engine is off, oil drains from the phaser's internal chambers by gravity. On the next start, the empty phaser rattles until oil pressure refills the unit and establishes hydraulic control. At 110,000 miles with proper oil maintenance, the phaser is simply showing age-related wear in its internal clearances that allows it to drain faster and take longer to refill.

22. C — The clearance is 3.5010 minus 3.4985, which equals 0.0025 inches — exceeding the maximum specification of 0.0020 inches by 0.0005 inches. [C] This excessive clearance will allow the piston to rock in the bore, producing piston slap noise (especially when cold) and increasing blowby past the rings. The bore needs to be honed to the next standard oversize and a corresponding oversize piston installed, or a different piston with a slightly larger skirt diameter must be selected to bring the clearance within specification.

23. B — A head gasket breach that is small or intermittent may not produce enough combustion gas at idle to change the block test fluid color. [A] Running the engine at 2,500 RPM under load significantly increases cylinder pressure during each combustion event, forcing more gas through the gasket breach into the coolant. The increased volume of combustion gas in the coolant during the second test was sufficient to react with the test fluid and produce a color change. This is why block tests should be performed at elevated RPM if the initial idle test is negative but suspicion remains high.

24. D — Engine oil does not raise the boiling point of coolant — the oil and coolant systems are separate, and oil has no direct chemical or physical interaction with the coolant's boiling point. [D] All other choices are legitimate functions of engine oil: it absorbs heat from pistons and bearings (cooling function), fills the ring-to-bore gap (sealing function), and holds contaminants in suspension for the filter

to capture (cleaning function). The coolant boiling point is raised by system pressure from the radiator cap, not by engine oil.

25. C — The journal measures 2.6365 inches, which is 0.0015 inches below the minimum standard specification of 2.6380 inches. [C] Even though the surface is smooth and unworn in appearance, the diameter is below the minimum dimension for standard bearings to achieve the correct oil clearance. The journal must be reground to the next undersize (0.010 under) and matching undersize bearings installed. Installing standard bearings on an undersize journal would result in excessive clearance and low oil pressure.

26. A — A deep thudding noise from the lower engine at idle that does not change when any individual cylinder is disabled is the diagnostic pattern for worn main bearings. [D] Main bearings support the crankshaft and absorb forces from all cylinders, so disabling one cylinder does not significantly reduce the load on any single main bearing — the knock persists. Connecting rod bearing knock, by contrast, diminishes or disappears when the specific affected cylinder is disabled because removing combustion load from that piston eliminates the impact force on that rod's bearing.

27. B — A radiator cap that releases at 11 PSI instead of its rated 16 PSI opens its pressure relief valve prematurely during normal operation. [D] At normal operating temperature, the cooling system builds pressure to approximately 14 to 16 PSI. The weak cap vents coolant to the overflow tank every time pressure reaches 11 PSI — well before the system reaches its normal operating pressure. Over repeated heat cycles, coolant is progressively pushed out to the overflow and lost, requiring the customer to add coolant regularly. Replacing the cap eliminates the premature venting.

28. D — Both technicians are correct. [B] Technician A is right: the head gasket must be placed over the block's alignment dowel pins first, ensuring it is precisely positioned before the heavy cylinder head is lowered onto it. This prevents the gasket from shifting and misaligning passages. Technician B is also right: gaskets marked "TOP" or "THIS SIDE UP" have a designated orientation — the marked side faces the cylinder head, and installing the gasket upside down can block coolant passages or misalign oil drains.

29. C — With the battery, starter, and all cable connections verified as good, the remaining variable is the mechanical resistance the engine presents to the starter. [E] In cold weather, engine oil thickens significantly — if the installed viscosity is too heavy for the ambient temperature (for example, 10W-30 in sub-zero conditions when 0W-20 or 5W-20 is specified), the thickened oil increases internal friction to the point where the starter struggles to crank the engine at normal speed despite having adequate power. Using the manufacturer's specified cold-weather viscosity resolves the condition.

30. A — Torque-to-yield bolts are intentionally stretched beyond their elastic limit during installation. [C] After being torqued and angle-turned to their specified value, they are permanently elongated. When removed, a TTY bolt measures longer than its original manufactured length because the stretching is permanent — the bolt does not return to its original dimension. This permanent deformation is precisely why TTY bolts must never be reused — reinstalling an already-stretched bolt would result in insufficient or unpredictable clamping force.

31. B — All four compression readings are within specification and within 10% of each other, which rules out engine mechanical causes for the rough idle. [A] The rough idle is being caused by something other than a compression or internal sealing problem — likely an ignition, fuel, vacuum, or sensor issue. The A1 technician's role is to confirm that the engine's mechanical condition is sound so that diagnostic efforts can be directed to the correct system. Good compression readings are a definitive pass for engine mechanical integrity.

32. D — A 0.003-inch deep scratch on a block deck surface intended for an MLS head gasket is a significant defect that will cause a leak. [C] MLS gaskets require an extremely smooth surface finish (15 to 30 microinches Ra) and cannot bridge a scratch of this depth — the elastomer coating is far too thin to conform to a 0.003-inch groove. Sealant and sanding are not acceptable repairs for MLS gasket surfaces. The block deck must be resurfaced on a milling machine to remove the scratch and restore the required surface finish and flatness.

33. A — Uniformly low compression across all cylinders (105 to 110 PSI versus the 145 to 165 PSI specification) immediately following a timing belt service is the signature of incorrect camshaft-to-crankshaft timing alignment. [A] If the timing is off by one tooth, all cylinders are affected equally because the valve events are retarded (or advanced) uniformly. The engine runs but with significantly reduced compression, power, and efficiency. Rechecking and correcting the timing mark alignment resolves the condition.

34. C — Superficial heat checking (a network of fine surface cracks that do not penetrate the full flywheel thickness) can be removed by resurfacing the flywheel friction surface to a specified minimum thickness. [C] Resurfacing removes the heat-damaged layer and restores a smooth, flat surface for the clutch disc. Deep cracks that extend through the flywheel or extend to the bolt holes require replacement, but superficial heat checking is a common serviceable condition that machining corrects.

35. B — A ticking noise that appeared immediately after an oil change on an engine that was quiet beforehand should first be investigated at the oil filter. [D] An incorrect oil filter (wrong bypass valve pressure, wrong anti-drainback valve, or restricted flow capacity) can reduce oil delivery to the valvetrain, causing hydraulic lifters to bleed down and produce ticking. The filter is the only component

that changed during the service, making it the most logical first suspect. Verifying the filter application number against the manufacturer's specification is a quick check.

36. D — The out-of-round is 3.7830 minus 3.7812, which equals 0.0018 inches, exceeding the maximum specification of 0.0015 inches. [C] An out-of-round condition this far beyond specification means the bore is no longer circular enough for new rings to maintain consistent contact around the circumference. The bore must be bored to the next oversize to restore a true cylindrical shape, then honed to final dimension with the correct crosshatch pattern for ring seating.

37. A — Both technicians are correct. [A] Technician A is right: the PCV fresh air inlet hose connects to the clean side of the air filter housing so that the air entering the crankcase has already been filtered of dirt and debris. Technician B is also right: if the fresh air inlet is disconnected, unfiltered ambient air enters the crankcase directly, carrying dust, dirt, and moisture that contaminate the engine oil and accelerate wear on all internal components.

38. A — Technician A only is correct: a 50/50 mixture of antifreeze and water provides the best overall protection for most climates, balancing freeze protection (typically to minus 34°F), boil-over protection, and heat transfer efficiency. [D] Technician B is wrong because straight antifreeze (100% ethylene glycol) actually has a higher freezing point (approximately minus 8°F) than a 50/50 mixture and transfers heat less efficiently. The water component is essential for both lowering the freeze point and improving the coolant's ability to absorb and transfer heat.

39. C — Air leaking from both the intake and exhaust simultaneously during a leak-down test at what should be TDC compression means both valves are partially open at the same time. [A] On a compression stroke, both valves should be fully closed. If the camshaft timing has jumped multiple teeth, the valve events are so far out of phase that the piston reaches TDC with both valves still partially open from the overlap period. This produces the unusual finding of simultaneous leakage at both the intake and exhaust — a pattern that no single valve failure can produce.

40. D — A high-pitched whine that increases with RPM and is loudest at the timing cover/oil pump area points to the oil pump as the noise source. [D] Worn oil pump gears or rotors with excessive internal clearances can produce a whining or cavitation noise as oil flows turbulently through the enlarged clearance gaps. The noise tracks directly with engine RPM because the pump speed is proportional to crankshaft speed. The timing cover and oil pump area location distinguishes it from alternator or idler pulley bearing noise, which would be loudest at the accessory drive.

41. A — A valve spring with a free height of 1.85 inches that falls below the minimum specification of 1.90 inches has taken a set and lost its designed spring rate. [B] A spring that has shortened beyond

specification produces less closing force at its installed height, which can allow the valve to float at higher RPM or fail to seat fully, causing compression loss and potential valve-to-piston contact. Free height cannot be corrected with shims — shimming compensates for installed height, not free height. The spring must be replaced.

42. C — A cooling system that holds pressure with no leaks during a static test but overheats intermittently in heavy traffic on hot days points to an airflow or heat rejection problem rather than a coolant leak. [D] The cooling fan system is the primary suspect because heavy traffic means low vehicle speed with minimal ram air through the radiator — the fan must compensate. Testing the fan motor operation, relay, temperature switch, and wiring under actual hot, idle conditions replicates the failure scenario and is the most targeted next diagnostic step.

43. B — A main bearing cap that does not fit snugly in its saddle indicates the mating surfaces have been damaged — fretting from cap micro-movement under load has roughened the contact surfaces and altered the fit. [C] Fretting means the bore is likely no longer true, and the block may need align boring or honing to restore the correct bearing bore geometry. A cap from another position would not even align with the bolt holes, and bearing shell thickness does not prevent the cap from seating against the block.

44. A — Replacing or repairing only the worn exhaust valve guides and installing new exhaust valve stem seals is the most cost-effective and technically appropriate repair when only the exhaust guides are out of specification. [B] The intake guides are within specification and do not require service. Replacing all eight guides when only four are worn is unnecessary expense. Installing new seals without repairing the guides would not solve the oil consumption problem because the excessive guide clearance allows the valve to wobble, preventing even a new seal from controlling oil effectively.

45. D — A brief puff of black smoke on quick throttle opening that does not persist during steady-state operation is caused by the fuel system's transient enrichment strategy providing a momentary rich pulse to prevent hesitation during rapid throttle transitions. [E] This is a normal fuel system response — the PCM commands extra fuel during the rapid transition from closed throttle to open throttle. On carbureted vehicles, the accelerator pump provides this enrichment mechanically. In either case, the brief rich condition produces a small amount of black smoke that is considered normal operation.

46. C — Before any engine disassembly, the fuel system pressure must be relieved to prevent high-pressure fuel spray when disconnecting fuel lines, and the battery must be disconnected to eliminate any risk of electrical shorts, sparks, or accidental starter engagement during the work. [E] These are safety-critical steps that must precede all other disassembly operations. Draining oil, removing manifolds, and removing exhaust components are all subsequent steps that follow after the system has been made safe.

47. B — A small decrease in oil pressure (5 PSI) after 3,000 miles on a rebuilt engine is normal break-in behavior. [D] New bearings, rings, and other mating surfaces undergo a controlled wear-in process during the first several thousand miles. As bearing surfaces burnish and establish their final running clearances, the clearances open very slightly from their as-assembled dimensions, allowing marginally more oil flow and producing a small, normal decrease in measured pressure. This stabilizes after the initial break-in period.

48. B — An intermittent cold-start-only misfire on a specific cylinder that clears once the engine warms, with verified-good compression, coil, plug, and injector, points to a marginally burned exhaust valve that only leaks when the valve and seat are cold and contracted. [A] As the engine warms and thermal expansion closes the gap at the burn point, the valve seals adequately and the misfire stops. This is an early-stage valve failure that will progressively worsen as the burn area enlarges. A leak-down test performed on the cold engine may confirm the exhaust valve leakage.

49. D — Testing each cylinder with only its own spark plug removed is incorrect procedure — all spark plugs must be removed before testing any cylinder. [A] Leaving plugs installed in the untested cylinders forces the starter to compress the charge in those cylinders during cranking, which slows the cranking speed unevenly and produces artificially low compression readings on the cylinder being tested. All other options describe correct compression test procedures: engine at operating temperature, throttle wide open, and all plugs removed.

50. C — A crankshaft that becomes noticeably tighter after torquing a single rod cap — beyond the slight, gradual increase expected from adding each assembly — suggests the rod cap bolts were over-torqued, distorting the big-end bore into a slightly oval shape. [C] An oval bore pinches the bearing against the journal and creates excessive drag at that location. The word "noticeably" is the key diagnostic clue — normal incremental friction from adding a rod (option A) would produce only a slight, barely perceptible increase, not a noticeable change. The technician should loosen the cap, verify the torque wrench calibration, retorque to the correct specification, and recheck crankshaft rotation. If tightness persists at the correct torque, the rod bore roundness should be measured with a bore gauge.