PRACTICE EXAM 15: ASE A1 ENGINE REPAIR SIMULATION (50 QUESTIONS)

1. A technician is diagnosing a V8 engine with an intermittent single-cylinder misfire that occurs only during sustained highway cruise between 2,200 and 2,500 RPM. The misfire does not occur at idle, during acceleration, or above 3,000 RPM. The spark plug, coil, and injector have been swapped and the misfire stays on cylinder 7. Compression is 152 PSI — within specification. A leak-down test shows 9% leakage with faint air at the tailpipe. Which of the following is the MOST likely cause of this speed-specific misfire?

A. A burned exhaust valve on cylinder 7 that only leaks enough to cause misfire at the specific combustion pressures generated in the 2,200 to 2,500 RPM cruise range

B. A harmonic vibration in the valvetrain at that specific RPM range that causes the number 7 exhaust valve to briefly unseat from resonance

C. A marginally leaking exhaust valve that is masked by higher cylinder pressures at idle (low volume) and at higher RPM but is exposed in the mid-range cruise window where combustion conditions are least forgiving

D. A VVT phaser on bank 2 that moves the exhaust cam to a position that creates insufficient valve overlap at cruise RPM

2. A customer reports that after driving through heavy rain, the engine began running rough and the check engine light started flashing. The engine misfires on all cylinders intermittently. After parking in a garage overnight, the engine starts and runs perfectly the next morning with no codes. Which of the following is the MOST likely cause?

A. Moisture on the ignition system components — coil connectors, plug boots, or ignition wiring — that caused misfires until the components dried

B. Water ingestion through the air intake that caused hydrostatic lock symptoms until the water evaporated

C. A saturated air filter that restricted airflow enough to cause a rich misfire until the filter dried overnight

D. Water contamination in the fuel tank from the heavy rain that settled to the bottom overnight and was picked up

3. A technician is rebuilding a V6 engine and discovers that the crankshaft main journal number 3 has a scratch approximately 2 inches long and 0.001 inches deep running along the axis of the journal. The scratch can be felt with a fingernail. All journal diameter measurements are within standard specification. The scratch was likely caused by debris during the previous engine's operation. Which of the following is the correct action?

A. Polish the scratch with fine emery cloth to smooth it and install standard bearings because the journal is within specification

B. Install the standard bearings as-is because the scratch depth is within the normal surface roughness tolerance

C. Apply a high-pressure assembly lubricant over the scratch to fill and seal it during initial break-in operation

D. Regrind the journal to the first undersize to machine below the scratch depth and install matching bearings

4. A four-cylinder engine with 140,000 miles exhibits a vacuum gauge reading of 16 in. Hg at sea level that is rock-steady with zero fluctuation at idle. Compression readings are: Cyl 1 = 132, Cyl 2 = 128, Cyl 3 = 130, Cyl 4 = 135. The specification is 145 to 165 PSI. All readings are below specification but within 10% of each other. A wet test improves all cylinders by 15 to 20 PSI. Which of the following BEST explains the steady but low vacuum reading?

A. The steady vacuum indicates the valves are sealing well despite the low compression from ring wear

B. The uniformly low compression from ring wear reduces engine breathing efficiency, lowering the absolute vacuum level while maintaining steadiness because all cylinders are equally affected

C. The vacuum gauge is reading incorrectly low because the gauge hose has a partial restriction

D. The low compression is caused by retarded valve timing that also reduces vacuum uniformly across all cylinders

5. A rebuilt engine has been running for 2,000 miles. The customer reports that the oil level has dropped from the full mark to one quart low. There is no visible external leak and no exhaust smoke at any condition. A compression test shows all cylinders 5 to 10 PSI higher than the pre-rebuild measurements. Oil pressure is within specification. The PCV system is functional. Which of the following BEST explains the oil consumption on a recently rebuilt engine with higher-than-original compression?

A. The piston rings are still in the break-in seating process and oil consumption decreases as the rings fully conform to the bore

B. The valve stem seals are defective and allowing oil past the guides at a rate too slow to produce visible smoke

C. The cylinder bores were honed with an incorrect crosshatch angle that prevents proper oil retention

D. The oil pump is delivering excessive pressure that is forcing oil past the piston ring end gaps under pressure

6. Technician A says that the thermostat bypass passage allows coolant to circulate through the engine block and heater core while the thermostat is closed during warm-up. Technician B says that the bypass passage prevents a dead-head condition at the water pump that could cause cavitation and impeller damage. 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

7. A technician is diagnosing an engine that produces a rhythmic knocking noise from the lower engine area. The knock is present at idle and increases in intensity when the engine is loaded. Disabling individual fuel injectors one at a time, the knock diminishes noticeably when cylinder 4 is disabled. However, the knock does not completely disappear — a faint residual knock remains. Which of the following BEST explains the incomplete noise elimination?

A. Cylinder 4 has both a rod bearing knock and a main bearing knock occurring simultaneously

B. The knock is actually from a loose wrist pin on cylinder 4 that produces residual noise even without combustion load

C. The connecting rod bearing on cylinder 4 has failed, but the vibration also excites the adjacent main bearing journal

D. The knock is partially transmitted through the block from cylinder 4's rod bearing to adjacent rod bearing positions, producing residual structural noise even when cylinder 4 is unloaded

8. A customer reports that the engine temperature gauge reads approximately 10% higher than it did before a recent coolant flush service. The gauge previously sat at the exact midpoint; it now sits slightly above midpoint at all conditions. The coolant level is correct, the system holds pressure, the fan operates correctly, and a block test is negative. The customer mentions the shop used a different brand of antifreeze than what was in the system previously. Which of the following is the MOST likely cause?

A. The new antifreeze has a lower boiling point that causes the coolant to run at a slightly higher temperature

B. The coolant mixture ratio is incorrect — too much antifreeze relative to water, reducing the mixture's heat transfer efficiency

C. The new antifreeze brand contains additives that are incompatible with the ECT sensor and causing a false reading

D. The thermostat was damaged during the coolant flush and now opens at a slightly higher temperature than before

9. A technician is measuring piston-to-bore clearance during an engine rebuild. The bore measures 3.5010 inches. The piston skirt diameter at the specified measurement point measures 3.4985 inches. The manufacturer's clearance specification is 0.0015 to 0.0025 inches. Which of the following is the correct assessment?

A. The clearance of 0.0025 inches is at the maximum specification and is acceptable for assembly

B. The clearance of 0.0025 inches exceeds the specification maximum and requires a larger piston

C. The clearance of 0.0015 inches is at the minimum specification and the bore should be honed larger

D. The clearance of 0.0020 inches is in the middle of the specification and is ideal for assembly

10. A rebuilt engine produces a brief puff of blue smoke from the exhaust each time the engine is restarted after sitting for 30 minutes or more. The smoke does not appear during cold start in the morning, during acceleration, at cruise, or during deceleration. Oil consumption is negligible. Which of the following is the MOST likely cause?

A. Worn piston rings that temporarily lose their seal during the 30-minute cool-down period between starts

B. A PCV valve that sticks open during the cool-down period and draws oil vapor into the intake manifold

C. Valve stem seals that allow a small amount of oil to pool on the valve heads during the brief sitting period, which burns on restart

D. Assembly lubricant residue that is still burning off from internal surfaces during the first 1,000 miles

11. A vehicle with an inline-6 engine is brought in with a complaint of gradually increasing oil consumption over the past year. Current consumption is one quart every 1,000 miles. The engine has 175,000 miles. Compression shows all six cylinders between 118 and 128 PSI — all below the 145 to 170 specification. A wet test improves all cylinders by 20 to 25 PSI. There is faint blue haze from the exhaust at all operating conditions. Oil pressure is 16 PSI at hot idle (specification minimum 12 PSI). Which of the following MOST accurately describes this engine's condition?

A. The engine has an isolated valve guide problem that is causing the smoke at all conditions

B. The engine has generalized wear throughout — rings, bores, and bearings — with oil pressure approaching minimum

C. The engine has a PCV system malfunction that is drawing excessive oil into the intake at all speeds

D. The engine has generalized ring and bore wear producing the oil consumption, smoke, and low compression, while the still-above-minimum oil pressure indicates the bearings are worn but not yet failed

12. A technician is installing a new timing belt on a DOHC interference engine. After aligning all timing marks and installing the belt, the technician rotates the engine two full revolutions by hand. At the end of the second revolution, the crankshaft mark is perfectly aligned, the intake cam mark is perfectly aligned, but the exhaust cam mark is off by half a tooth. Which of the following is the correct action?

A. Start the engine because half a tooth is within the acceptable tolerance for timing belt installation

B. Remove the belt, realign all marks, and reinstall the belt — even half a tooth can cause valve contact or performance issues on an interference engine

C. Advance the exhaust cam sprocket by loosening its bolt and rotating it to align the mark, then retighten

D. The half-tooth deviation is caused by the tensioner and will self-correct once the engine starts and oil pressure tensions the belt

13. A customer's vehicle has a check engine light with code P0128 (coolant temperature below thermostat regulating temperature). The engine takes significantly longer than normal to reach operating

temperature. The heater blows lukewarm air during the extended warm-up. Once the engine reaches operating temperature, it maintains it and the heater works normally. Which of the following is the MOST likely cause?

A. A thermostat that is stuck partially open, allowing coolant to flow to the radiator prematurely during warm-up

B. A failed coolant temperature sensor that is reporting a lower-than-actual temperature to the PCM

C. A water pump with excessive impeller clearance that circulates coolant faster than the engine can heat it

D. A radiator cap with a lower-than-rated pressure that allows the boiling point to drop and triggers the code

14. A V8 engine produces a vacuum reading that floats very slowly between 17 and 19 in. Hg at idle over a period of approximately 10 seconds. The fluctuation is smooth and wave-like — not the sharp, rhythmic dip associated with a valve problem. All eight cylinders have compression within specification and within 5% of each other. Fuel trims are within plus or minus 3% on both banks. Which of the following is the MOST likely cause of this gentle vacuum oscillation?

A. A very minor exhaust restriction that creates subtle back-pressure waves affecting the intake vacuum reading

B. Normal idle speed variation from the PCM's idle control algorithm adjusting for minor load fluctuations

C. A small, intermittent vacuum leak at a gasket surface that opens and closes slightly with thermal expansion

D. An EGR valve that is not fully closed and allows a very small amount of exhaust gas to enter the intake

15. Technician A says that an engine with a 10.5:1 compression ratio is more likely to experience detonation on 87 octane fuel than an engine with a 9.5:1 compression ratio. Technician B says that modern engines with high compression ratios use direct fuel injection and advanced knock control strategies to operate on regular octane fuel despite ratios that would have required premium fuel in older designs. 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

16. A freshly rebuilt engine exhibits a condition where the oil pressure drops momentarily to near zero for approximately one second during hard right turns, then immediately recovers. Oil level is at the full mark. The condition does not occur during straight-line driving, left turns, or during braking. Which of the following is the MOST likely cause?

A. The oil pickup tube is positioned too high in the pan and is uncovered when oil sloshes left during right turns

B. The oil pump has a worn check valve that allows oil to drain back during lateral G-force loading in turns

C. A main bearing has excessive clearance on one side only and dumps oil pressure when gravity loads shift

D. The oil pickup tube is positioned too close to the right side of the pan and is uncovered when oil sloshes away during right-hand turns

17. A technician is performing a valve job on a cylinder head and discovers that one exhaust valve seat insert has receded below the head deck surface by approximately 0.010 inches. The valve sits deeper in the head than all other valves. Which of the following consequences has this recession produced?

A. The valve closes further from its designed position and the spring installed height has increased beyond specification

B. The valve now protrudes further into the combustion chamber, reducing clearance to the piston crown

C. The valve seat has increased the compression ratio on that cylinder by reducing combustion chamber volume

D. The valve stem now extends further out of the guide, increasing stem-to-guide clearance at the seal area

18. A customer brings in a vehicle with a turbocharged engine stating that boost pressure drops from the normal 16 PSI to approximately 8 PSI after 10 minutes of spirited driving, then recovers to 16 PSI after

the engine cools for a few minutes. The check engine light is on with a P0234 overboost code from a previous event. The wastegate moves freely. Which of the following is the MOST likely cause?

A. A failing turbocharger bearing that seizes when heat-soaked and releases when cooled

B. A boost leak that develops only when the charge air piping expands under sustained heat and reseals when cool

C. An intercooler that becomes heat-saturated under sustained boost and reduces charge air density until cooled

D. The turbocharger exhaust housing is cracking under heat and diverting exhaust away from the turbine wheel

19. A technician is diagnosing an engine with an intermittent stalling complaint. The stall occurs unpredictably — sometimes in traffic, sometimes at highway speed, sometimes at idle — with no consistent pattern. The engine always restarts immediately. No codes are stored. All engine mechanical tests are normal. Fuel pressure, ignition, and all sensor data appear normal during monitored test drives. The technician has been unable to reproduce the stall. Which of the following diagnostic approaches is MOST likely to identify this intermittent fault?

A. Replace the most commonly failing components one at a time until the stalling stops occurring

B. Perform a wiggle test on all engine harness connectors and ground connections while monitoring for signal drops

C. Install a new PCM because intermittent stalls with no codes indicate a processor fault

D. Install a continuous data logger that records all sensor data, fuel pressure, and ignition signals over several days of normal driving to capture the conditions present at the moment of the next stall

20. A technician is inspecting the oil pan during an engine rebuild. The pan has a large internal baffle plate that divides the sump area. The baffle has a small trap door (flap) near the bottom that opens in one direction only. Which of the following describes the purpose of this baffle and trap door assembly?

A. The baffle prevents oil from sloshing away from the pickup during cornering, braking, and acceleration, and the trap door allows oil to flow toward the pickup but prevents it from flowing away

B. The baffle separates dirty oil from clean oil and the trap door allows fresh oil to circulate while trapping sediment

C. The baffle reduces windage losses from the crankshaft counterweights contacting the oil surface during operation

D. The baffle directs the oil return flow from the cylinder head drain-backs to the pickup side of the pan

21. An engine that was rebuilt 500 miles ago develops a sudden, loud rod knock at highway speed. The technician immediately pulls the vehicle over and shuts the engine off. Oil level is full and the oil appears clean. The technician has the vehicle towed to the shop. Upon removing the oil pan, the number 3 connecting rod bearing cap is found with severe scoring on both bearing halves. The crankshaft rod journal shows heat discoloration but no deep scoring. Oil galleries appear clean. Which of the following assembly errors MOST likely caused this premature failure?

A. The rod cap was installed reversed (180 degrees from its correct orientation) during assembly

B. The rod bearing was installed without the locating tang properly seated in its notch and the bearing shifted during operation

C. The bearing clearance was at the tight end of specification and an oil restriction developed at high RPM

D. The rod bolt was undertorqued, allowing the cap to shift under load and distort the bearing bore

22. A customer reports that the engine runs perfectly at all times except during cold start on mornings when the temperature is below 40°F. On those mornings, the engine cranks at noticeably slower speed and sometimes barely starts. Once started, it runs normally. The battery was replaced six months ago and tests good. The starter current draw test is within specification when performed in the shop at room temperature. Which of the following is the MOST likely cause?

A. A mechanical connection issue — corroded battery terminals, cable ends, or ground straps — that increases resistance only when cold temperatures contract the metals and widen the micro-gaps in the corroded joint

B. Engine oil that is too thick for the cold temperature, requiring more cranking effort than the starter can provide

C. The engine has high compression that requires more cranking effort in cold temperatures when the air charge is denser

D. The starter motor brushes are worn and make intermittent contact when cold but work normally when warm

23. A technician removes the valve cover on a DOHC engine during a noise investigation and discovers that one exhaust cam lobe appears significantly more worn than all others — the lobe profile is visibly rounded rather than pointed. The lifter (cam follower) riding on this lobe shows a deep concave wear pattern on its contact surface. The engine has 160,000 miles. Which of the following explains why this single lobe and follower wore while the others did not?

A. This lobe likely experienced a lubrication failure at some point — either from a momentary oil starvation event or a clogged oil passage feeding that specific cam journal — that initiated the wear, and once initiated, the damaged surfaces accelerated each other's deterioration

B. The lobe was manufactured with a metallurgical defect that made it softer than the other lobes from new

C. The valve spring at this position was set with excessive pressure that overloaded the cam lobe contact area

D. The exhaust valve at this position stuck open at some point and the cam lobe continued to push against the stuck valve

24. A technician performs a block test on a vehicle with a suspected head gasket failure. The test is performed with the engine at operating temperature and idling. The test fluid changes color within 30 seconds — a strongly positive result. The technician then shuts the engine off, waits five minutes, restarts, and performs the test again. This time, the fluid does not change color after three minutes. Which of the following BEST explains why the second test was negative?

A. The first test used up all the combustion gas in the coolant and the second test had no gas to detect

B. The head gasket breach sealed itself temporarily when the engine was shut off and restarted

C. The combustion leak test fluid became saturated during the first test and could not change color a second time

D. A head gasket breach to a coolant passage can produce intermittent results because the breach may only leak when the engine has been running long enough for the gasket to reach full thermal expansion and distortion

25. A vehicle owner reports that the engine's oil level is rising between oil changes despite no oil being added. The oil does not smell like fuel and does not appear milky. The coolant level in the reservoir has been dropping at approximately the same rate. The engine has no visible external leaks. Oil pressure and compression are within specification. Which of the following is the MOST likely cause?

A. An internal engine crack between an oil gallery and a coolant passage that allows coolant to seep into the oil

B. A leaking intake manifold gasket on a V-type engine where the gasket separates the coolant crossover from the oil valley

C. A failed internal barrier in the engine oil cooler that allows coolant to cross into the oil under the cooling system's higher operating pressure

D. A head gasket failure that is directing coolant from a passage into an oil drain-back channel in the gasket

26. A rebuilt engine has been running for 10,000 miles. During a routine oil change, the technician notices the oil has a grayish discoloration and a slight sweet smell. The oil level is exactly at the full mark. The coolant level is approximately half a pint low. No white smoke is visible from the exhaust. The engine runs normally with no misfires or codes. Which of the following is the MOST appropriate action?

A. Perform only a standard oil change because the discoloration is from normal combustion byproducts

B. Perform a block test at idle and at elevated RPM, a cooling system pressure test, and an oil analysis to investigate the suspected coolant contamination

C. Replace the head gaskets immediately because the gray oil and sweet smell definitively confirm a coolant breach

D. Add coolant to restore the level and recheck in 1,000 miles to determine if the coolant loss continues

27. A technician is assembling a rebuilt engine and needs to verify that the new oil pump pickup tube is sealed properly at the pump housing connection. The tube uses an O-ring seal at the pump body. After installation, the technician notices the O-ring is slightly visible — extruding approximately 1/32 inch from the joint. Which of the following is the correct interpretation?

A. The visible O-ring indicates it was pinched or not fully seated during installation and must be reinstalled to prevent an air leak that reduces pump priming

B. A slightly visible O-ring is normal and indicates the seal is compressed and seated in the joint properly

C. The O-ring is too large for the application and should be replaced with a smaller-diameter ring

D. The O-ring extrusion has no effect on pump performance because the tube connection is submerged in oil

28. A customer reports that the engine produces a loud ticking noise that was not present before a recent spark plug change performed by a quick-service shop. The noise tracks with engine RPM and is localized to the cylinder head area on the right bank. Oil level and pressure are correct. Which of the following should the technician check FIRST?

A. The valve lash on the right bank to verify the adjustment was not disturbed during the plug change

B. The camshaft lobes on the right bank for damage that may have been caused by debris from the plug change

C. The timing chain tension to determine if it was affected by the spark plug service procedure

D. Whether a spark plug on the right bank was left loose or not torqued to specification, allowing exhaust gas to tick past the plug seat

29. A technician is inspecting the cylinder head from a V6 engine that overheated severely. The head passes a pressure test at 40 PSI with no leaks. A dye penetrant test reveals no cracks on the deck surface or combustion chamber areas. However, when the technician visually inspects the exhaust ports, a fine hairline crack is visible running between the number 2 and number 3 exhaust port walls inside the port area. Which of the following is the correct action?

A. The crack is in a non-critical area between exhaust ports and does not affect sealing — the head can be reused

B. Replace the cylinder head because an internal exhaust port crack can propagate to the deck surface or a coolant passage under continued thermal cycling

C. Weld-repair the crack from inside the exhaust port and then resurface the head before reinstallation

D. Seal the crack with a high-temperature exhaust sealant applied inside the port before reassembly

30. A V8 engine with 220,000 miles produces an oil pressure reading of 8 PSI at hot idle and 28 PSI at 2,500 RPM. The specification is 10 PSI minimum at idle and 40 to 65 PSI at speed. The engine has a faint but detectable rod knock at idle. The customer asks the technician whether switching to 20W-50 oil (the manufacturer specifies 5W-30) would be a viable strategy to continue driving the vehicle for a few more months. Which of the following is the MOST accurate response?

A. The heavier oil will restore both pressure readings to within specification and eliminate the rod knock entirely

B. The heavier oil will not increase oil pressure at all because pressure is determined only by the pump and clearances

C. The heavier oil will temporarily increase oil pressure readings and may reduce the knock intensity, but it will not repair the worn bearing surfaces and the engine remains at risk of sudden failure

D. The heavier oil will eliminate the knock but will cause the engine to overheat from increased oil friction

31. A technician discovers during a valve job that the intake valve seats on a four-cylinder head are all within specification, but the intake valve margin on the number 3 intake valve is only 1/64 inch (approximately 0.015 inches) after grinding. The minimum margin specification is 1/32 inch (approximately 0.031 inches). Which of the following is the correct action?

A. Replace the number 3 intake valve because the margin is below specification and the valve is at risk of burning from insufficient heat dissipation at the thin edge

B. Lap the valve to its seat more aggressively to widen the contact area and compensate for the thin margin

C. Install the valve as-is because the margin is close enough to specification for practical service life

D. Regrind the valve at a slightly different face angle to increase the margin at the expense of seat width

32. A technician is diagnosing an engine that produces a rhythmic clicking noise at idle from the valvetrain area. Using a stethoscope, the technician isolates the noise to the number 4 intake rocker arm area. The technician removes the valve cover and observes the rocker arm motion — the number 4 intake rocker arm appears to have slightly more play than the adjacent rocker arms. The engine has hydraulic lifters. Which of the following is the MOST likely cause of the excess play?

A. The number 4 intake pushrod is slightly bent and is not maintaining correct geometry in the rocker arm

B. The rocker arm pivot ball at the number 4 intake position has worn and developed excessive clearance

C. The hydraulic lifter at the number 4 intake position has an internal defect and is not pumping up to zero lash

D. The camshaft intake lobe for cylinder 4 has lost lift and the lifter cannot compensate for the reduced base circle

33. A customer reports that the engine loses approximately one pint of coolant every two weeks. There are no visible external leaks. The engine oil is clean. The exhaust shows no white smoke. A cooling system pressure test holds at 16 PSI for 30 minutes. A block test at idle and at 2,500 RPM is negative on both tests. Which of the following remaining diagnostic tests is MOST likely to identify the coolant loss source?

A. A cylinder leak-down test to check for air entering the coolant from a combustion-to-coolant breach

B. An ultraviolet dye test where coolant dye is added and the vehicle is driven for 200 miles before UV inspection

C. A borescope inspection of each cylinder through the spark plug holes looking for coolant residue or steam cleaning

D. An exhaust gas analysis looking for elevated hydrocarbon and water vapor content that indicates coolant combustion

34. An inline-4 engine with a timing chain develops a gradual onset of rough idle, reduced power, and increased fuel consumption over the past 10,000 miles. No codes are stored. A compression test shows all four cylinders between 120 and 128 PSI — below the 145 to 160 specification. A timing light connected to cylinder 1 shows the timing mark is retarded approximately 8 degrees from the specified base timing position. Which of the following BEST explains all of these symptoms?

A. The ignition system has drifted out of calibration and the PCM needs a base timing reset procedure

B. The compression readings are low because of ring wear, and the retarded timing is a separate unrelated issue

C. The fuel injectors have gradually become restricted, causing lean misfires that mimic retarded timing behavior

D. The timing chain has stretched, retarding the camshaft timing and reducing compression, power, and efficiency

35. Technician A says that an engine's oil consumption rate can increase temporarily during the first 1,000 miles after a rebuild because the piston rings have not fully seated against the freshly honed bore. Technician B says that if oil consumption does not decrease significantly by 2,500 miles after a rebuild, there may be a ring installation error or a bore finish problem. 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

36. A technician is measuring valve spring pressure on a set of used springs during an engine rebuild. Most springs produce 85 lbs at their installed height — within the 80 to 90 lb specification. However, three springs measure only 68 to 72 lbs at the same height. Which of the following is the correct action?

A. Install all springs because the low springs will regain pressure once the engine reaches operating temperature

B. Replace all springs as a complete set because mixing springs of different pressures creates uneven valve control

C. Replace only the three weak springs with new springs that meet the 80 to 90 lb specification

D. Shim the three weak springs to increase their installed pressure into the specification range

37. A customer reports a single brief metallic snapping sound from the engine each morning on the first cold start. The sound occurs once and does not repeat. It is not a click, tick, or rattle — it is described as a sharp, singular snap. The engine starts and runs normally afterward. No codes are stored. Which of the following is the MOST likely cause?

A. A hydraulic lifter that is fully collapsed overnight and produces a single snap as the lash adjuster takes up all slack on the first cam revolution

B. A serpentine belt idler pulley bearing that has a flat spot that produces a single impact on the first rotation before smoothing out

C. A VVT cam phaser that has drained oil overnight and produces a single snap as the locking pin engages or disengages on the first oil pressure event

D. A starter drive gear that does not fully disengage from the ring gear on the first start and produces a snap as it releases

38. A technician is rebuilding an engine and needs to verify that the cylinder head bolt holes in the block are in good condition. The technician runs a thread chaser through each hole. On three of the twelve holes, the thread chaser removes visible amounts of debris and thread sealant. On one hole, the chaser

turns hard for two turns and then smooths out, with small aluminum shavings visible on the chaser threads. Which of the following is the correct interpretation and action for the difficult hole?

A. The debris removal on the three holes is normal maintenance and the hard-turning hole had minor contamination that was cleared

B. The three holes needed cleaning and the hard-turning hole has slightly damaged threads that the chaser reformed

C. All four holes need thread inserts because any resistance during thread chasing indicates compromised threads

D. The hard-turning hole has damaged threads that require a thread insert because the chaser produced aluminum shavings, indicating material was removed from the bore

39. An engine exhibits a condition where the oil pressure is normal at idle (30 PSI) but rises to only 35 PSI at 2,500 RPM instead of the expected 45 to 65 PSI. The oil level and viscosity are correct. A new oil pump was installed 5,000 miles ago. Which of the following is the MOST likely cause?

A. The oil pressure relief valve is opening prematurely — either from a weak spring, debris holding the valve partially open, or an incorrect relief valve spring installed during the pump replacement

B. The new oil pump has worn prematurely from contamination and can no longer generate adequate pressure

C. The main bearing clearances are at the tight end of specification and are restricting oil flow at higher RPM

D. The oil filter is too restrictive and is limiting the volume of oil the pump can push through the system

40. A rebuilt engine produces normal oil pressure and compression. However, during the first 100 miles, the technician notices that the engine runs slightly rough at hot idle but smooths out above 1,500 RPM. A scan tool shows short-term fuel trims fluctuating between minus 8% and plus 6% at idle — wider swings than the typical plus or minus 3%. No codes are stored. The roughness gradually diminishes over the next 500 miles. Which of the following BEST explains this temporary condition?

A. The new piston rings are not yet fully seated and slight blowby at idle creates uneven cylinder pressure

B. The PCM's fuel trim adaptation is recalibrating after the rebuild to account for the slightly different airflow characteristics of new gaskets, seals, and engine clearances

C. The new oxygen sensors installed during the rebuild need a break-in period before they respond accurately

D. The intake manifold gasket is not sealing properly and will require replacement once the roughness persists

41. A technician is diagnosing a vehicle where the engine overheated after the customer reported a sweet smell from under the hood. The coolant level is very low. There are no visible external leaks when the engine is cold. The technician adds coolant and pressure-tests the system. After 10 minutes, a small drip of coolant appears from the front of the engine near the timing cover area. The drip stops after 15 minutes and does not restart despite the system remaining pressurized. Which of the following BEST explains this intermittent leak behavior?

A. The leak is from a gasket surface that seals at some pressures but leaks at others due to thermal cycling

B. A hairline crack in the timing cover expands under pressure until the rubber material relaxes and seals again

C. The coolant was displaced from a small cavity during pressure testing and appeared as a drip rather than an actual leak

D. The timing cover gasket or seal has a small defect that leaks only until the gasket material swells from coolant contact and temporarily re-seals under system pressure

42. A technician is rebuilding a high-mileage engine and discovers that the crankshaft main bearing bore on number 4 measures 0.002 inches larger in diameter than the remaining four bores when the cap is torqued to specification. All caps are confirmed in the correct positions and orientations. The bearing surface in the bore shows scoring marks. Which of the following MOST likely caused this condition?

A. The previous engine overheated and warped the block casting at the number 4 main bearing position only

B. A previous bearing failure at position number 4 caused the bearing to spin, scoring and enlarging the bore

C. The number 4 main cap bolts stretched during a previous overtorque event and permanently enlarged the bore

D. Factory casting porosity at the number 4 position that progressively enlarged under cyclic bearing loading

43. A customer brings in a vehicle with an engine that has been burning oil for 50,000 miles. Current consumption is one quart every 600 miles. The customer does not want to rebuild the engine. A compression test shows all six cylinders between 125 and 135 PSI — below the 145 to 165 specification. The customer asks if switching to a higher-viscosity oil than the manufacturer specifies would reduce the oil consumption. Which of the following is the MOST accurate response?

A. A higher-viscosity oil may modestly reduce oil consumption by creating a thicker film that is harder for combustion pressure to blow past the worn rings, but it will not stop the consumption and may reduce fuel economy and cold-start protection

B. A higher-viscosity oil will completely stop the oil consumption by sealing the worn ring-to-bore gaps

C. A higher-viscosity oil will have no effect at all on oil consumption because viscosity does not affect ring sealing

D. A higher-viscosity oil will increase engine wear because it flows too slowly to lubricate the bearings at startup

44. A technician is performing a leak-down test on all eight cylinders of a V8 engine. Seven cylinders show 5% to 10% leakage. Cylinder 6 shows 35% leakage with air audible at the intake manifold and at the tailpipe simultaneously, but NOT at the oil filler cap or in the coolant. Which of the following conditions would produce this specific pattern?

A. A head gasket failure between the cylinder 6 combustion chamber and both the intake and exhaust ports

B. Two separate valve failures — a burned intake valve and a burned exhaust valve on the same cylinder

C. Both the intake and exhaust valves on cylinder 6 are not sealing, which could result from incorrect valve timing, valve deposits, or a cam timing issue affecting both valves on that cylinder

D. A cracked cylinder head that allows air to leak through both the intake and exhaust port walls simultaneously

45. A vehicle has been brought in with a complaint that the engine hesitates briefly when the accelerator is pressed after the vehicle has been coasting downhill with the throttle closed for more than 10 seconds. The hesitation lasts about one second and then the engine responds normally. No codes are stored. Compression and all engine mechanical tests are normal. Which of the following is the MOST likely cause?

A. Low compression on one cylinder that only becomes apparent during the transition from deceleration to acceleration

B. A worn throttle position sensor that sends incorrect signals during the transition from closed to open throttle

C. An exhaust restriction that builds back-pressure during the deceleration event and momentarily disrupts combustion

D. The fuel injectors have been shut off during deceleration fuel cut and the brief hesitation is the fuel system repressurizing and the PCM resuming injector operation

46. A technician discovers during an engine teardown that the main bearing cap bolts on positions 2 and 4 have been previously replaced with standard hardware-store grade 8 bolts of the correct thread and length. The original bolts are manufacturer-specified fasteners with unique torque specifications. Which of the following is the MOST significant concern about the hardware-store replacements?

A. Grade 8 bolts are stronger than the original specification and may have overtorqued the caps

B. Hardware-store bolts may not have the same fatigue resistance, stretch characteristics, or hardness as the manufacturer-specified fasteners, and their use compromises the integrity of the main bearing bore clamping

C. The replacement bolts have a different thread pitch that may have damaged the block threads

D. Grade 8 bolts are too soft for main bearing cap applications and will stretch under normal operating loads

47. A rebuilt engine has been running for 3,000 miles with perfect performance. During a routine check, the technician notices a very small weep of oil at the junction where the oil pan gasket meets the rear main seal housing — the three-way junction point. The oil is a thin film, not a drip. Crankcase pressure is normal. Which of the following is the MOST likely cause?

A. Insufficient or improperly applied RTV sealant at the three-way junction where the pan, block, and seal housing meet — a common assembly oversight

B. A failing rear main seal that is leaking oil along the housing surface to the pan junction area

C. Excessive oil pressure that is forcing oil past the pan gasket at the weakest sealing point

D. The oil pan gasket has shrunk from heat cycling and no longer seals at the rear junction area

48. A customer reports that the engine produces a single brief puff of white smoke from the exhaust after the vehicle has been parked for exactly 30 minutes to one hour. The smoke does not appear on cold morning starts, during driving, or after parking for less than 15 minutes or more than two hours. Coolant level is stable. Oil is clean. A block test is negative. Which of the following BEST explains this very specific timing pattern?

A. A very minor head gasket breach that only leaks during the specific thermal state of the engine during the 30 to 60 minute cool-down window

B. Condensation that forms in the exhaust system specifically during the 30 to 60 minute cooling window when components are warm enough to produce moisture but cool enough for it to condense

C. A very small coolant seep past a valve stem seal that only pools enough coolant to produce visible smoke during the 30 to 60 minute window when the engine is cooling and vacuum is absent

D. An intake manifold gasket coolant seep that allows coolant to pool in the intake runner only during the specific temperature range of the 30 to 60 minute cool-down

49. Technician A says that an engine that has been overheated severely should always have the crankshaft checked for straightness even if it appears undamaged. Technician B says that severe overheating can warp a crankshaft by creating uneven thermal expansion between the journals and counterweights. Who is correct?

A. Technician A only

B. Both Technician A and Technician B

C. Technician B only

D. Both technicians make valid points — severe overheating can affect the crankshaft, and checking for straightness is a prudent precaution during any rebuild of a previously overheated engine

50. A technician has completed an engine rebuild and is preparing for the first start. The oil system has been pre-primed with a drill-driven priming tool. Oil pressure reached 45 PSI during priming. All fluids are filled. The cooling system is full. The battery is fully charged. Which of the following is the MOST critical action during the actual first start and initial run?

A. Rev the engine to 3,000 RPM immediately to break in the camshaft and lifters on a flat-tappet engine

B. Verify oil pressure registers on the gauge within the first 3 seconds and shut down immediately if pressure does not appear, because a dry-start condition can destroy bearings in seconds

C. Allow the engine to idle for 30 minutes to break in the rings before increasing RPM above idle speed

D. Disable the fuel system and crank the engine for 30 seconds to verify oil pressure before allowing it to start

Practice Exam 15: 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 — A marginally leaking exhaust valve produces a misfire only when combustion conditions are least able to compensate for the leak. [A] At idle, cylinder pressures are low but the slow engine speed allows more time for the charge to burn — marginal but survivable. At WOT, the massive charge volume overwhelms the small leak. At high RPM cruise, increased gas velocity helps scavenge and fill the cylinder. The mid-range cruise window of 2,200 to 2,500 RPM combines moderate charge volume with moderate combustion pressure — the specific combination where the valve leak's proportional effect is most damaging.

2. A — An engine that misfires on all cylinders during heavy rain and then runs perfectly after drying overnight is the classic presentation of moisture contamination on the ignition system. [E] Water spray from driving through heavy rain can reach coil-on-plug connectors, spark plug boots, and ignition wiring harness connections. The moisture creates conductive paths that short-circuit the high-voltage spark energy, causing misfires across multiple cylinders. Once the components dry — naturally overnight in a garage — the conductive paths disappear and ignition returns to normal.

3. D — A scratch that is 0.001 inches deep and can be felt with a fingernail on a crankshaft main journal is a significant defect that will destroy a new bearing. [C] The sharp edges of the scratch act as a scraper that digs into the soft bearing material, scoring the bearing and generating metallic debris that circulates through the oil system. Polishing alone cannot remove a 0.001-inch scratch — the journal must be reground to a smaller undersize that machines below the scratch depth, restoring a smooth, undamaged surface for the new undersize bearing.

4. B — A vacuum reading that is low but rock-steady indicates all cylinders are contributing equally — no single cylinder is worse than the others. [A] When ring wear is uniform across all four cylinders, each

cylinder leaks approximately the same amount of compression, reducing overall engine breathing efficiency (hence the lower vacuum) but maintaining consistency between cylinders (hence the steady needle). If one cylinder had a valve problem or significantly worse rings, the needle would dip rhythmically. The steady-but-low pattern is the signature of uniform generalized wear.

5. A — One quart of oil consumption in 2,000 miles on a rebuilt engine with compression that is actually higher than pre-rebuild readings is consistent with piston rings that are still in the break-in seating process. [C] New rings installed in freshly honed bores undergo a controlled micro-wear process during the first 2,000 to 5,000 miles where the ring face conforms to the bore surface. Until this seating is complete, a small amount of oil passes the not-yet-fully-conformed ring-to-bore interface. The higher compression confirms the bore and rings are mechanically correct — they simply need more mileage to fully seat.

6. C — Both technicians are correct. [D] Technician A correctly describes the bypass passage's circulation function: while the thermostat is closed during warm-up, coolant must still flow through the engine block and heater core to prevent hot spots and provide cabin heat — the bypass provides this internal circulation path. Technician B correctly identifies the hydraulic protection function: without the bypass, the water pump would push against a completely sealed system (dead-head condition) that could cause cavitation, seal damage, and impeller erosion.

7. D — A connecting rod bearing knock that diminishes significantly when its cylinder is disabled but does not completely disappear is explained by structural noise transmission through the engine block. [A] When cylinder 4 is disabled, the combustion load that drives the rod against the worn bearing is removed, eliminating the primary impact. However, the mechanical vibration from the impact has been transmitting through the rigid block structure to adjacent bearing positions. This residual structural vibration continues briefly as stored energy in the block dissipates, producing the faint remaining knock.

8. B — A temperature gauge that reads approximately 10% higher after a coolant flush with a different antifreeze brand — with all other components testing normal — points to an incorrect coolant mixture ratio. [D] Pure antifreeze transfers heat less efficiently than a proper 50/50 antifreeze-to-water mixture. If the flush was performed with too much antifreeze concentrate relative to water (for example, 70/30 instead of 50/50), the reduced heat transfer capacity causes the engine to stabilize at a slightly higher operating temperature. Verifying the concentration with a refractometer confirms the diagnosis.

9. A — The bore measures 3.5010 inches and the piston measures 3.4985 inches: 3.5010 minus 3.4985 equals 0.0025 inches. [C] This clearance of 0.0025 inches falls at the maximum of the 0.0015 to 0.0025 specification — it is within the acceptable range and the piston can be assembled. While it is at the

upper limit rather than the ideal middle, it meets specification. The piston may produce a slight cold piston slap that disappears as the aluminum piston expands to its operating clearance.

10. C — Blue smoke that appears specifically after sitting for 30 minutes or more — but NOT on cold morning starts — indicates oil is pooling on the valve heads during the brief sitting period. [A] After the engine is turned off, residual oil in the valve cover and on the cam journals drains downward. Valve stem seals that are slightly worn or marginally sealing allow this oil to seep past and pool on the closed valve face. On restart, the pooled oil is drawn into the combustion chamber and produces the brief smoke puff. Cold morning starts may not show this if the oil drains further down overnight.

11. D — All findings paint a comprehensive picture: uniformly low compression with wet test improvement across all six cylinders confirms generalized ring and bore wear; faint blue haze at all conditions confirms constant oil bypass past the rings; and oil pressure at 16 PSI (above the 12 PSI minimum) indicates the bearings are worn but still within specification. [A] This engine has systemic wear throughout its power train — rings, bores, and bearings are all aging together — but no single catastrophic failure has occurred. The oil pressure, while still above minimum, is trending toward eventual failure.

12. B — On an interference engine, even half a tooth of timing deviation can cause a valve to contact a piston — the clearances are measured in thousandths of an inch, and half a tooth represents several degrees of camshaft rotation. [B] The belt must be removed, all marks realigned precisely, and the belt reinstalled. Assuming half a tooth is "close enough" or will self-correct risks catastrophic valve and piston damage the moment the engine starts. The two-revolution verification test exists specifically to catch this type of installation error before the engine runs.

13. A — Code P0128 specifically indicates the engine is not reaching the expected operating temperature within the PCM's calibrated time window — the thermostat is not regulating properly. [D] A thermostat stuck partially open allows coolant to flow to the radiator continuously from the moment the engine starts, preventing the engine from warming up at the designed rate. The coolant reaches the radiator prematurely and is cooled before the engine achieves operating temperature. Once the engine eventually warms (overcoming the constant cooling), the thermostat's partial opening maintains temperature adequately.

14. C — A slow, smooth vacuum oscillation of 2 in. Hg over a 10-second period — without sharp dips and with normal compression and fuel trims — is most consistent with a minor intermittent vacuum leak at a gasket surface that changes slightly with thermal expansion. [A] As the intake manifold or cylinder head temperature fluctuates microscopically during idle, a marginal gasket joint opens and closes by tiny

amounts. The resulting air leak varies smoothly with the thermal cycle, producing the gentle wave-like vacuum pattern rather than the sharp, rhythmic dip of a valve problem.

15. A — Both technicians are correct. [A] Technician A correctly states the fundamental principle: higher compression ratios produce higher peak cylinder pressures and temperatures, which increase the tendency for the end gas to auto-ignite (detonate) before the flame front reaches it. Technician B correctly identifies the modern engineering countermeasure: GDI engines use the fuel's evaporative cooling effect inside the cylinder plus sophisticated knock sensors and ignition timing control to suppress detonation, allowing high compression ratios to operate safely on regular octane.

16. D — Oil pressure dropping to near zero during hard right turns only — with correct oil level — indicates the oil pickup tube is positioned such that oil sloshes away from it specifically during right-turn lateral loading. [D] During a hard right turn, centrifugal force pushes the oil to the left side of the pan. If the pickup tube entrance is located closer to the right side or center of the pan, the oil moving left can uncover the screen, causing the pump to draw air momentarily. The immediate recovery confirms the pickup re-submerges as soon as the lateral force ends.

17. B — When a valve seat recedes (sinks deeper into the head), the valve follows it downward and sits lower than its designed position in the head. [B] This increases the distance from the valve spring retainer to the spring seat — the installed height — beyond specification. The increased installed height reduces the spring's compression, which reduces the closing force applied to the valve. Reduced closing force can allow the valve to float at higher RPM or fail to seat fully, causing compression loss and potential valve burning.

18. C — Boost that performs normally for 10 minutes and then drops by half until cooled is the pattern of an intercooler that becomes thermally saturated under sustained boost demand. [A] The intercooler's function is to cool the compressed charge air from the turbocharger. Under sustained spirited driving, the intercooler absorbs more heat than it can reject to ambient air, and the charge air temperature rises. Hotter air is less dense, reducing the effective oxygen content of the charge. The PCM reduces boost to protect the engine, and the P0234 code is from a previous event where boost exceeded limits before the PCM intervened.

19. D — An intermittent stall with no codes, no consistent pattern, and no reproducibility during monitored test drives requires capturing the exact conditions present at the moment of failure — which can only be accomplished by continuous long-term data logging during the customer's normal driving routine. [A] A data logger records all sensor values, fuel pressure, RPM, and ignition signals continuously. When the stall finally occurs during normal driving, the recorded data from the seconds

before and during the event reveals the failing parameter. This approach avoids the expensive and unreliable strategy of replacing components one at a time.

20. A — The oil pan baffle with a one-way trap door is an oil control system designed to keep oil near the pump pickup during dynamic driving conditions. [D] During hard cornering, braking, or acceleration, oil attempts to slosh away from the pickup. The baffle physically blocks the oil from moving to the far side of the pan, and the trap door allows oil that has been pushed away to flow back toward the pickup (the door opens toward the pickup side) but prevents it from flowing away (the door closes against flow away from the pickup). This ensures the pickup remains submerged under all driving conditions.

21. B — A rod bearing that fails at 500 miles with clean oil galleries and correct oil level points to an assembly error at that specific bearing position. [C] The bearing locating tang must seat precisely in its notch in the rod bore. If the tang was not properly seated, the bearing shell can shift position during operation, moving the oil feed hole out of alignment with the rod's oil supply passage. The misaligned oil hole starves the bearing surface, the oil film breaks down, and the bearing scores and overheats within a few hundred miles.

22. A — Slow cranking in cold temperatures that tests normal in the warm shop points to a connection issue that worsens with cold. [E] Corroded battery terminals, cable ends, or ground connections have micro-gaps between the corroded surfaces. At room temperature, these gaps may be small enough to allow adequate current flow. In cold temperatures, the metal contracts and the micro-gaps widen, increasing resistance significantly. The increased resistance reduces the current reaching the starter, slowing cranking speed. Cleaning and tightening all connections resolves the cold-sensitive cranking problem.

23. A — A single cam lobe and its matching follower wearing while all others remain within specification indicates a localized lubrication failure at that specific position — not a systemic oil problem. [B] The most likely cause is a momentary oil starvation event at that cam journal — perhaps from a partially blocked oil feed hole, debris temporarily blocking the passage, or air entrainment during a low-oil episode. Once the initial surface damage occurred (micro-welding between the lobe and follower), the roughened surfaces accelerated each other's wear in a self-reinforcing cycle that continued even after normal oil flow resumed.

24. D — A block test that is positive when the engine is at full operating temperature but negative after a cool restart is consistent with a head gasket breach that is temperature-dependent. [A] At full operating temperature, the aluminum head and steel block have expanded to their maximum dimensions, and the differential thermal expansion distorts the gasket enough to open the breach. After shutting off and

restarting within 5 minutes, the components have cooled slightly but not enough to reopen the breach immediately — the gasket temporarily reseals until the engine reaches full thermal expansion again.

25. C — An oil level that rises by the same amount that the coolant level drops — with no fuel odor, no milky oil, and no external leaks — indicates coolant is crossing into the oil through an internal pathway. [D] The liquid-cooled engine oil cooler is the most likely source because it operates with coolant on one side and oil on the other, separated by a thin barrier. The cooling system operates at approximately 16 PSI while the crankcase is near atmospheric, so when the barrier fails, coolant crosses into the lower-pressure oil side. Early-stage contamination may not yet produce visible milkiness.

26. B — Grayish oil discoloration and a sweet smell, combined with a coolant level that is half a pint low, are early indicators of coolant contamination in the oil — but the findings are subtle enough that they require confirmation before committing to an expensive repair. [D] A block test at idle and at elevated RPM checks for combustion-to-coolant breach. A cooling system pressure test checks for external or internal leaks under pressure. An oil analysis definitively quantifies sodium, potassium, and glycol levels that confirm or rule out coolant contamination. These three tests together provide a definitive diagnosis.

27. A — An O-ring that is visibly extruding from the joint between the pickup tube and the pump body was pinched, rolled, or not properly seated during installation. [D] A correctly installed O-ring compresses into its groove and is not visible at the joint surface. An extruding O-ring has been displaced from its designed sealing position, creating a gap where air can be drawn into the pump's suction side. This air leak reduces the pump's ability to prime and maintain consistent oil pressure, particularly at idle when suction demand is lowest relative to the air leak volume.

28. D — A ticking noise that appeared immediately after a spark plug change, localized to the cylinder head area on one bank and tracking with RPM, should first be investigated at the spark plugs themselves. [E] A spark plug that was not properly torqued to specification — left loose — allows high-pressure combustion gas to leak past the plug seat with each power stroke, producing a rhythmic ticking sound synchronized with that cylinder's firing events. This is the simplest and most directly service-related cause, and checking plug torque takes seconds.

29. B — A hairline crack between exhaust port walls inside the port area — even though it did not affect the pressure test or deck surface dye penetrant inspection — represents a thermal fatigue failure that will propagate under continued service. [B] Exhaust ports experience the highest temperatures in the cylinder head, and cracks in this area are driven by repeated thermal cycling. The crack may eventually propagate outward to the deck surface (causing a gasket leak) or inward to a coolant passage (causing coolant contamination). The head should be replaced to prevent a progressive failure.

30. C — Switching to 20W-50 oil in an engine specified for 5W-30 will temporarily increase oil pressure readings because the thicker oil creates more resistance as it flows through the enlarged bearing clearances. [D] The thicker oil film may also dampen the rod knock by providing more cushioning between the worn bearing and journal. However, the heavier oil does not repair the worn surfaces — the metal-to-metal damage remains, and the bearing will continue to deteriorate. The engine is at risk of sudden bearing seizure regardless of oil viscosity.

31. A — The valve margin — the flat edge of the valve face above the seat contact area — serves as a heat dam that protects the thin combustion face from the extreme temperatures of the burning charge. [B] When the margin is ground below the minimum specification of 1/32 inch, the valve edge becomes too thin to dissipate heat adequately. The thin edge overheats during combustion, softens, and eventually burns through — a condition known as "tulipping" where the valve edge curls upward from thermal distortion. The valve must be replaced.

32. C — Visible excess play on one specific rocker arm compared to adjacent rocker arms on an engine with hydraulic lifters indicates the lifter at that position is not maintaining its designed zero-lash condition. [B] A hydraulic lifter with an internal check valve defect, a scored plunger bore, or debris under the check ball bleeds oil from its high-pressure chamber faster than the engine's oil supply can replenish it. The lifter collapses partially, creating the visible clearance between the rocker arm and the valve stem tip. The lifter must be replaced.

33. B — A coolant loss of one pint every two weeks with no visible leaks, clean oil, no white smoke, and negative pressure and block tests at both idle and elevated RPM has exhausted the standard diagnostic tests. [D] The next step is a UV dye test — adding fluorescent dye to the coolant and driving the vehicle for an extended period (200 miles) before inspecting every surface under ultraviolet light. The dye concentrates at the leak source and fluoresces brightly, revealing leaks too small for pressure testing or visual inspection to detect — including weep-rate leaks at gaskets, freeze plugs, and hose connections.

34. D — A timing chain that has stretched retards the camshaft relative to the crankshaft, producing uniformly low compression (the valves close too late to trap the full charge), reduced power (combustion occurs later in the stroke), poor fuel economy (incomplete combustion and retarded power delivery), and the timing mark appearing retarded (the stretched chain delays crankshaft-to-camshaft position). [A] All four symptoms — low compression, reduced power, poor economy, and retarded timing — are explained by a single cause: timing chain stretch that has retarded the camshaft timing by approximately 8 degrees.

35. A — Both technicians describe valid aspects of the ring break-in process. [C] Technician A correctly identifies that new rings in freshly honed bores undergo a controlled seating process during the first 1,000 miles where the ring face conforms to the bore surface, and some oil consumption during this period is expected. Technician B correctly identifies the diagnostic threshold: if oil consumption has not decreased significantly by 2,500 miles, the rings may have been installed incorrectly (wrong orientation, wrong end gap) or the bore finish may not be compatible with the ring type.

36. C — Three valve springs that measure 68 to 72 lbs at installed height — well below the 80 to 90 lb specification — have lost significant spring tension and cannot adequately control their respective valves. [B] Weak springs allow the valve to float at higher RPM, bounce on the seat at lower RPM, and fail to seal consistently. Replacing only the three weak springs (rather than the entire set) is acceptable as long as the replacements meet the specification — there is no requirement to replace springs that are within specification. Shimming weak springs is not recommended because the spring has lost its metallurgical tension.

37. B — A single sharp metallic snap on the first cold start that does not repeat is consistent with a serpentine belt idler pulley bearing that has developed a localized flat spot on its race. [E] When the engine is off overnight, the stationary pulley bearing rests with its load on a single point. If the race has a flat spot at that contact point, the first rotation produces a single sharp impact as the ball or roller passes over the defect. After the first rotation, the bearing is in continuous motion and the defect produces no further audible impact because the momentum carries the roller through the flat spot.

38. D — The three holes that required only debris and sealant removal during chasing are normal maintenance — the chaser cleaned them without issue. [C] The fourth hole, where the chaser turned hard and produced aluminum shavings, has damaged threads — the chaser physically removed block material to pass through. This means the original thread form has been compromised. A thread insert (HeliCoil or Time-Sert) must be installed to provide new, hardened steel threads that will properly hold a head bolt at full torque. Simply chasing damaged threads does not restore their original strength.

39. A — Normal oil pressure at idle (30 PSI) but pressure that barely rises at 2,500 RPM (35 PSI versus the 45 to 65 specification) indicates the oil pressure relief valve is capping maximum pressure at approximately 35 PSI. [D] The relief valve should not open until pressure reaches the upper specification range. If the valve is opening prematurely — from a weak spring, debris preventing full closure, or an incorrect spring installed during the pump replacement — it diverts oil back to the pan at a lower pressure than designed, preventing the system from reaching specification at speed.

40. B — A rebuilt engine with slightly rough idle and wider-than-normal fuel trim swings that gradually resolve over 500 miles is exhibiting the PCM's fuel trim adaptation process recalibrating to the rebuilt

engine's new characteristics. [A] A rebuild changes gasket thicknesses, sealing characteristics, intake runner surface finish, throttle body position, and numerous other variables that affect airflow. The PCM's learned fuel trim values from the old engine are no longer accurate. The PCM gradually re-learns the optimal fuel delivery through closed-loop correction, and the roughness diminishes as the adaptation converges on the new baseline.

41. D — A timing cover gasket or seal that leaks briefly under pressure testing and then stops is exhibiting the characteristic behavior of a gasket material that swells slightly when exposed to coolant. [D] The initial leak occurs because the gasket or seal has a small defect — a nick, a thin spot, or an area of inadequate compression. When coolant reaches this defect under pressure, it seeps through. Within minutes, the gasket material absorbs a small amount of coolant and swells, closing the defect and stopping the leak. This is a temporary self-seal that will fail again under different temperature conditions.

42. B — A single main bearing bore that is 0.002 inches larger than all others — with the correct cap in the correct position and scoring visible in the bore — indicates a previous bearing failure at that specific location where the bearing spun in the bore. [C] A spinning bearing generates extreme friction heat and mechanical abrasion that enlarges and scores the bore beyond its designed diameter. The bore must be corrected by align boring or line honing the entire main bore set to restore correct alignment and geometry before new bearings are installed.

43. A — A higher-viscosity oil creates a thicker oil film between the worn ring face and the cylinder bore wall, which provides marginally more resistance to combustion gas blowing past the ring. [D] This can modestly reduce — but not eliminate — oil consumption on a worn engine. However, the trade-offs include reduced fuel economy (thicker oil increases internal friction), slower cold-start oil delivery (thicker oil takes longer to reach the valvetrain), and potential violation of the manufacturer's viscosity specification that may affect warranty or emissions compliance.

44. B — Air leaking simultaneously from both the intake manifold and the tailpipe on the same cylinder — with no air at the oil filler cap or coolant — means both the intake and exhaust valves on cylinder 6 are not sealing. [A] Two separate valve failures on the same cylinder are uncommon but possible on a high-mileage engine — particularly if a cam timing issue has affected both valves' ability to seat. Alternatively, carbon deposits on both valve seats, or a cam phaser failure that mistimes both the intake and exhaust events on that cylinder, could produce the same result.

45. D — Modern fuel-injected engines use deceleration fuel cut (DFCO) — the PCM shuts off the fuel injectors during closed-throttle deceleration to improve fuel economy and reduce emissions. [E] When the driver presses the accelerator after a sustained deceleration period, the fuel system must reinitiate

injector operation, repressurize the fuel rail to its operating specification, and transition from fuel-cut mode back to normal fueling. This transition takes a fraction of a second — producing the brief hesitation before normal power delivery resumes. This is a normal operating characteristic, not a fault.

46. B — Manufacturer-specified main bearing cap bolts are engineered for the specific fatigue resistance, stretch characteristics, and hardness required to maintain consistent clamping force over millions of load cycles at the extreme conditions inside an engine. [C] Hardware-store grade 8 bolts, while strong in static applications, may not have the same fatigue life, controlled elongation properties, or consistent metallurgical characteristics. The risk is not that they are too weak in tension — it is that their clamping force may relax unpredictably over time, leading to cap movement and bearing bore distortion.

47. A — The junction where the oil pan gasket, the block deck, and the rear main seal housing meet is the most common oil leak point on any engine because three separate sealing surfaces converge at a single area. [D] Most manufacturers require a specific RTV sealant application at this three-way junction during assembly — typically a small dab of sealant on each side where the pan gasket meets the seal housing. If this sealant was omitted, applied insufficiently, or contaminated during assembly, the three-surface intersection will not seal and oil weeps from the joint under crankcase pressure.

48. B — The very specific 30 to 60 minute timing window corresponds to the temperature range where the exhaust system components are warm enough to produce moisture from ambient humidity but cool enough for that moisture to condense on the interior surfaces as liquid water. [E] Before 15 minutes, the exhaust is still too warm for significant condensation. After two hours, the system has cooled to ambient and condensation has evaporated. The 30 to 60 minute window is the precise thermal sweet spot for maximum condensation formation. On restart, the hot exhaust vaporizes this condensed water, producing the brief white puff that the customer observes.

49. D — Both technicians make valid and complementary points about the effects of severe overheating on the crankshaft. [C] Technician A correctly identifies the prudent practice: checking crankshaft straightness should be standard procedure during any rebuild of an engine that has been severely overheated, even if the crankshaft shows no visible damage. Technician B correctly explains the mechanism: extreme heat can create uneven thermal expansion between the journals (which are cooled by oil) and the counterweights (which are not), potentially warping the crankshaft. Both statements support the same conclusion.

50. B — The most critical action during the first seconds of a new engine's operation is confirming that the oil pressure gauge registers pressure within the first 3 seconds. [D] Even with pre-priming, the running engine's higher oil demand can reveal problems that the slower pre-prime did not — a

misaligned bearing, a blocked gallery, or a failed relief valve. If pressure does not appear immediately, every second of dry operation destroys bearing material that took hours to assemble. Shutting down instantly at the first sign of absent pressure saves the engine from catastrophic damage.