PRACTICE EXAM 11: ASE A1 ENGINE REPAIR SIMULATION (50 QUESTIONS)

1. A technician is diagnosing a V6 engine that has a rough idle and intermittent misfires on bank 2 (cylinders 4, 5, and 6). Long-term fuel trim on bank 2 is plus 15%. Compression readings are: Cyl 4 = 145, Cyl 5 = 148, Cyl 6 = 150, all within specification. Bank 1 fuel trim is plus 2% and all bank 1 cylinders are within 5 PSI of each other. Which of the following is the MOST likely cause of the bank 2 symptoms?

A. Worn piston rings on all three bank 2 cylinders reducing compression and causing rich misfires

B. A vacuum leak on the bank 2 intake manifold runner or gasket causing a lean condition on that bank

C. A failing fuel pump that delivers less fuel to bank 2 injectors due to rail pressure imbalance

D. Worn valve guides on all three bank 2 cylinders allowing oil to contaminate the combustion charge

2. A four-cylinder engine has been running normally for 80,000 miles since its timing belt was replaced at a dealer. The engine suddenly develops a rough idle with a flashing check engine light and codes P0301 and P0302 (cylinder 1 and 2 misfires). Compression on cylinders 1 and 2 reads 45 PSI each. Cylinders 3 and 4 read 155 PSI each. The engine is an interference design. Which sequence of events MOST likely produced this condition?

A. The timing belt jumped teeth on the camshaft sprocket, bending valves on cylinders 1 and 2

B. Both head gaskets failed simultaneously between cylinders 1 and 2 and their adjacent coolant passages

C. The number 1 and 2 exhaust valve seats dropped out of the cylinder head into the combustion chambers

D. Severe detonation on cylinders 1 and 2 cracked the pistons and destroyed their ring seal completely

3. A technician is investigating an oil consumption complaint on a turbocharged GDI engine with 70,000 miles. There are no external leaks. The PCV system is functional. Exhaust shows a faint blue haze under boost only — no smoke at idle or deceleration. Compression is within specification on all cylinders. The turbocharger shaft has no measurable radial play, and the oil drain line flows freely. Which of the following is the MOST likely cause?

A. Worn valve stem seals that leak oil under the positive intake pressure of boost conditions

B. A leaking turbocharger compressor seal that allows oil past the seal ring under boost pressure

C. Low-speed pre-ignition damage to piston ring lands that has compromised ring sealing under load

D. Worn turbocharger turbine seals that allow oil into the exhaust stream during high exhaust flow

4. A technician performs a cylinder leak-down test on a V8 engine. Cylinder 3 shows 15% leakage with faint air at the oil filler cap. Cylinder 4 shows 18% leakage with faint air at the oil filler cap and very faint bubbles in the coolant overflow. No air is heard at the intake or exhaust on either cylinder. Which of the following BEST describes the condition of these two cylinders?

A. Both cylinders have worn rings only, and the bubbles in the coolant are from a separate issue

B. Cylinder 3 has worn rings and cylinder 4 has a rod bearing failure transmitting noise to the coolant

C. Both cylinders share a head gasket failure that is allowing air into both the crankcase and coolant

D. Cylinder 3 has moderate ring wear and cylinder 4 has both ring wear and a minor head gasket breach to coolant

5. A rebuilt engine develops a persistent ticking noise from the valvetrain 48 hours after first startup. The noise is isolated to the number 2 exhaust rocker arm on this OHV engine. Oil pressure is 55 PSI at idle. The lifter was verified as functional during assembly. The camshaft is new. Which of the following should the technician check FIRST?

A. The oil gallery feeding the number 2 lifter bore for a restriction that starves the lifter of pressure

B. The pushrod for the number 2 exhaust valve to verify it is the correct length for the application

C. The camshaft lobe for the number 2 exhaust to verify it has not already developed flat-spot wear

D. The rocker arm ratio to determine if the replacement rocker arm is the incorrect specification

6. Technician A says that an engine with a displacement of 2.0 liters and a compression ratio of 10:1 has a total cylinder volume at BDC of approximately 200 cubic centimeters per cylinder (on a 4-cylinder engine). Technician B says that the combustion chamber volume on this engine would be approximately 22 cubic centimeters per cylinder based on the 10:1 ratio. Who is correct?

A. Both Technician A and Technician B

B. Technician A only

C. Technician B only

D. Neither Technician A nor Technician B

7. A customer reports a rhythmic clicking noise from the engine that appeared gradually over the past month. The noise tracks with engine RPM and is present at all temperatures. The technician uses a mechanic's stethoscope and identifies the noise as loudest at the front of the engine near the crankshaft pulley area. The harmonic balancer appears intact with no visible outer ring shift. Which of the following should the technician investigate?

A. The crankshaft front main bearing for wear that would produce a clicking at the pulley location

B. The serpentine belt tensioner pulley bearing that may be failing and producing rhythmic clicks

C. The crankshaft pulley-to-balancer attachment bolt for looseness that allows cyclic movement

D. The timing chain tensioner for a ratchet mechanism that is clicking as it progressively extends

8. A technician discovers during a head gasket replacement that the aluminum cylinder head deck surface measures 0.004 inches of warpage diagonally. The specification allows 0.003 inches maximum. The head has been resurfaced once before. The current head thickness is 0.006 inches above the manufacturer's minimum thickness. Which of the following is the correct repair decision?

A. Resurface the head because removing 0.004 inches still leaves 0.002 inches above minimum thickness

B. Replace the head because the remaining material after resurfacing would be below minimum thickness

C. Install the head without resurfacing using a thicker gasket to compensate for the warpage amount

D. Resurface only 0.003 inches to bring the warpage within specification while preserving more material

9. A vehicle with a V8 engine and 220,000 miles exhibits oil pressure of 8 PSI at hot idle (specification minimum is 10 PSI) and 30 PSI at 2,500 RPM (specification is 40–65 PSI). The engine has a faint rod knock at idle that is most noticeable on cylinder 7. The customer asks if switching to a heavier-viscosity oil will solve the problem. Which of the following is the correct response?

A. A heavier oil will restore normal oil pressure and eliminate the knock permanently at all speeds

B. A heavier oil will mask the symptoms temporarily but will not repair the worn bearing surfaces

C. A heavier oil cannot increase oil pressure at all because pressure is determined only by the pump

D. A heavier oil will raise pressure but cause the engine to overheat from increased oil friction

10. A technician is diagnosing a six-cylinder engine with a steady vacuum reading of 15 in. Hg at sea level. All six cylinders show compression readings between 115 and 125 PSI. The specification is 145 to 165 PSI. A wet test improves all cylinders by 20 to 30 PSI. The engine uses one quart of oil every 1,200 miles and has 185,000 miles. Which of the following conditions do all of these findings COLLECTIVELY indicate?

A. A valve timing problem causing low compression and vacuum that is unrelated to ring wear

B. Generalized ring and bore wear producing uniformly low compression, low vacuum, and oil consumption

C. A head gasket failure on multiple cylinders that produces low compression without affecting vacuum

D. An exhaust restriction that artificially lowers both compression and vacuum readings simultaneously

11. A technician replaces the water pump on a vehicle. After reassembly and refilling the cooling system, the engine is started and runs for 10 minutes. The temperature gauge rises to normal and stabilizes. However, the customer returns the next day stating the engine overheated on the highway. The technician finds the coolant level is one quart low and there is a small air pocket when the bleeder screw is opened. Which of the following is the MOST likely cause of the overheating?

A. The replacement water pump has a defective impeller that cannot circulate coolant at highway speeds

B. The thermostat was damaged during the water pump service and is now sticking intermittently

C. Air trapped in the cooling system during the initial fill was not fully bled and expanded at highway temperature

D. The radiator cap was weakened during the service and is now releasing pressure below specification

12. A customer brings in a vehicle with a complaint that the engine surges at highway cruise — RPM fluctuates approximately 200 RPM up and down without any throttle input change. The condition appeared after an intake manifold gasket was replaced at another shop. No DTCs are stored. Compression is normal. Which of the following is the MOST likely cause?

A. The replacement intake manifold gasket is defective and has a pinhole that leaks under vacuum

B. The intake manifold bolts were over-torqued and have warped the manifold creating a vacuum leak

C. The ignition coils were disconnected during the gasket service and one was not fully reconnected

D. A vacuum hose was left disconnected or misrouted during the intake manifold gasket reassembly

13. A technician is rebuilding an OHV engine and discovers that the number 3 lifter bore in the engine block is scored and slightly enlarged. A new standard-size lifter has noticeable play when inserted into the bore. Which of the following is the correct repair?

A. Install an oversize oil pump to increase pressure at the lifter bore and compensate for the clearance

B. Ream the bore to the next oversize and install an oversize-diameter lifter for the number 3 position

C. Fill the scored bore with metallic epoxy and then hone it to the standard lifter diameter size

D. Use a standard lifter with a thicker retaining clip to hold it centered in the enlarged bore opening

14. A technician is performing an exhaust manifold removal on a cast iron head and discovers that three of the six manifold studs are corroded and seized in the head. The technician applies penetrating oil and allows it to soak for 30 minutes before attempting removal. Two studs break flush with the head surface during extraction. Which of the following is the MOST appropriate next step?

A. Carefully drill out the broken studs using a left-hand drill bit and attempt extraction with an EZ-Out

B. Weld a nut onto each broken stud to provide a surface for a wrench to grip during extraction

C. Apply heat directly to the aluminum around each stud to expand the hole and loosen the bond

D. Cut the remaining stud material flush and use a thread insert to install new studs in the repaired holes

15. A vehicle with a four-cylinder GDI turbocharged engine has 110,000 miles. The customer reports reduced power and the check engine light is on with a P0299 (turbo underboost condition) code. Boost pressure on the scan tool reaches only 8 PSI instead of the specified 18 PSI. There are no exhaust leaks. The wastegate actuator rod moves freely when disconnected. Which of the following is the MOST likely cause?

A. A clogged air filter that is limiting the volume of air reaching the turbocharger compressor inlet

B. A leak in the intake manifold gasket downstream of the throttle body reducing cylinder pressure

C. Worn turbocharger bearings that allow the shaft to wobble and the compressor wheel to contact the housing

D. A boost leak in the charge air piping between the turbocharger compressor outlet and the throttle body

16. Technician A says that when an engine is assembled, the first main bearing cap installed and torqued should be the center cap, working outward toward each end. Technician B says that main bearing caps should be torqued in sequence from front to rear to ensure uniform clamping force. Who is correct?

A. Technician A only

B. Technician B only

C. Neither technician is entirely correct — the manufacturer's specific sequence must be followed

D. Both Technician A and Technician B

17. A rebuilt engine has been running perfectly for 15,000 miles. During a routine oil change, the technician performs an oil pressure test: hot idle reads 20 PSI (specification minimum 15 PSI) and 2,500 RPM reads 42 PSI (specification 40–65 PSI). At the original 500-mile break-in test, readings were 30 PSI at idle and 55 PSI at 2,500 RPM. The customer asks if the engine is failing. Which of the following is the MOST accurate response?

A. The pressure decrease from break-in to 15,000 miles is normal bearing wear-in and all readings remain within specification

B. The 10 PSI idle pressure drop in 15,000 miles is excessive and indicates a premature bearing failure

C. The pressure is acceptable now but will likely fall below specification within the next 5,000 miles

D. The oil pump relief valve spring has weakened and should be replaced to restore higher pressures

18. A technician is diagnosing a noise that occurs only during engine cranking — a loud metallic grinding sound that stops the instant the engine fires and begins running. The noise does not recur during any running condition. Which of the following is the MOST likely cause?

A. A worn timing chain that rattles during cranking speed but quiets when oil pressure tensions it

B. The starter drive gear is not fully disengaging from the flywheel ring gear after the engine starts

C. A cracked flexplate ring gear that grinds against the starter pinion at the damaged tooth location

D. Excessive crankshaft end play that allows the crank to shift during the cranking torque application

19. A four-cylinder engine with 145,000 miles has the following compression results: Cyl 1 = 148, Cyl 2 = 155, Cyl 3 = 150, Cyl 4 = 108 PSI. The specification is 140 to 165 PSI. A wet test on cylinder 4 raises it to 112 PSI. A leak-down test on cylinder 4 shows 40% leakage with air heard at the intake manifold opening. Which of the following is the MOST likely cause?

A. Worn piston rings on cylinder 4 that are allowing excessive blowby past the ring pack at idle

B. A cracked piston crown on cylinder 4 allowing compression to escape into the crankcase below

C. A head gasket failure between cylinder 4's combustion chamber and the adjacent intake port

D. An intake valve on cylinder 4 that is burned, bent, or otherwise not seating properly

20. A technician is testing the cooling system on a vehicle with an intermittent overheating complaint. A pressure test holds steady for 20 minutes. A block test at idle is negative. The technician road tests the vehicle for 30 minutes in traffic. The engine temperature rises to near the redline during a long idle at a traffic light but drops immediately when the vehicle begins moving. Which of the following should the technician test NEXT?

A. The cooling fan operation under actual operating conditions to verify it activates when temperature rises

B. The thermostat opening temperature by removing it and bench-testing in heated water on the workbench

C. The head gasket by repeating the block test at elevated RPM under load on the dynamometer

D. The radiator flow capacity by measuring the inlet and outlet temperature differential during the road test

21. A technician discovers during an engine rebuild that the crankshaft has a hairline crack visible under magnetic particle inspection at the fillet radius of the number 4 rod journal. The crack is approximately 0.5 inches long. The journal surface itself is smooth and within measurement specification. Which of the following is the correct action?

A. Regrind the journal to a smaller undersize to machine below the crack depth and restore integrity

B. Polish the fillet radius with a fine stone to remove the surface stress riser and prevent propagation

C. Replace the crankshaft because a fillet radius crack is a fatigue failure that will propagate under load

D. Magnaflux the crack after engine assembly to monitor it during the first 500 miles of break-in operation

22. A vehicle has had its engine oil changed four times in the past year at four different quick-service shops. The technician finds that the current oil in the engine is a 10W-40 conventional oil. The manufacturer specifies 0W-20 full synthetic. The engine has a VVT system and is exhibiting a P0011 (camshaft position timing over-advanced) code. Which of the following explains the relationship between the incorrect oil and the VVT fault?

A. The heavier oil cannot flow through the fine VVT passages quickly enough to achieve commanded phaser positions

B. The 10W-40 oil is correct for this engine and the VVT code has a different unrelated root cause

C. Conventional oil lacks the additives needed to lubricate VVT components regardless of viscosity grade

D. The thicker oil generates excessive pressure that forces the cam phaser beyond its designed range of motion

23. A technician is evaluating a cylinder head that was removed from an engine with a blown head gasket. The gasket failure is between the number 2 combustion chamber and an oil return passage. There is also evidence of a minor external coolant weep at the deck surface near the number 4 cylinder. After resurfacing, the technician performs a pressure test on the head and finds no leaks. A dye penetrant test also reveals no cracks. Which of the following is the correct interpretation?

A. The head is ready for reinstallation because all post-machining tests are satisfactory and clear

B. The coolant weep at number 4 proves the head has a subsurface crack that will eventually reappear

C. The resurfacing may have removed the surface layer containing a crack that could still exist deeper

D. The head passes inspection and the gasket failure was caused by factors other than a head defect

24. Technician A says that when checking valve stem-to-guide clearance, the measurement should be taken at only the center of the guide where wear is least pronounced. Technician B says that the guide

should be measured at the top, middle, and bottom in two perpendicular directions to fully characterize wear. Who is correct?

A. Technician B only

B. Neither Technician A nor Technician B

C. Technician A only

D. Both Technician A and Technician B

25. A technician has just completed a head gasket replacement on a four-cylinder engine. The engine starts, runs smoothly, and all temperatures are normal after a 20-minute warm-up. A block test is negative. However, the technician notices a very faint haze of blue-white smoke from the tailpipe that was not present before the repair. Oil level is at the full mark. Coolant level is stable. Which of the following is the MOST likely cause of the new smoke?

A. The valve stem seals were damaged during the head removal and reinstallation process

B. Assembly lubricant or oil that entered the combustion chambers during head installation is burning off

C. The new head gasket has a minor breach that is allowing a small amount of oil past the seal

D. The piston rings were disturbed by debris that fell into the cylinders during the head service

26. A six-cylinder engine with 160,000 miles is diagnosed with a worn exhaust camshaft lobe on cylinder 5. The lobe has lost 0.020 inches of lift compared to the others. All intake cam lobes are within specification. The engine is a DOHC design with hydraulic lash adjusters. Which of the following symptoms would this worn lobe MOST likely produce?

A. A persistent ticking noise from the cylinder 5 exhaust position at all engine speeds and temperatures

B. A blue smoke puff from the exhaust each time cylinder 5 fires due to valve guide oil pull from reduced lift

C. Reduced power and a possible misfire on cylinder 5 from restricted exhaust gas evacuation

D. Increased compression on cylinder 5 because the exhaust valve opens less and traps more gas

27. A technician is installing a new set of main bearings during an engine rebuild. All bearing shells have been verified as the correct size. After installing the upper shells in the block saddles and carefully lowering the crankshaft, the technician notices that the crankshaft does not rest evenly in the saddles — one end sits approximately 0.010 inches higher than the other. Which of the following is the MOST likely cause?

A. The crankshaft is bent and needs to be replaced or straightened before bearing installation

B. One of the upper bearing shells has shifted out of its saddle and is sitting on top of the locating tang

C. The block has warped from the previous overheating event and the main saddles are no longer aligned

D. An upper bearing shell was installed in the wrong saddle position and is the incorrect thickness for that journal

28. Technician A says that an engine operating at 6,000 RPM has its camshaft rotating at 3,000 RPM. Technician B says that at 6,000 RPM, each cylinder in a four-cylinder engine fires 3,000 times per minute. 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

29. A customer brings in a vehicle stating that after a recent brake service, the engine stalls when the brake pedal is pressed firmly while sitting at a stop light. The engine restarts immediately when the brake is released. There were no engine problems before the brake service. Which of the following is the MOST likely cause?

A. The brake power booster was damaged during the brake service, creating a vacuum leak when applied

B. The brake booster vacuum hose was left disconnected or was kinked during the brake service work

C. The brake master cylinder is internally bypassing and creating a hydraulic resistance to the engine

D. The brake light switch was adjusted incorrectly and is interfering with the throttle position signal

30. A technician is performing a bore measurement on an engine block and gets the following readings on cylinder 1: top of bore perpendicular to crank = 3.5025, top parallel = 3.5020, middle perpendicular = 3.5012, middle parallel = 3.5010, bottom perpendicular = 3.5008, bottom parallel = 3.5007. The manufacturer's maximum taper specification is 0.002 inches and maximum out-of-round is 0.001 inches. Which of the following is correct?

A. Taper is 0.0017 inches and out-of-round is 0.0005 inches — both within specification, hone and reuse

B. Taper is 0.0017 inches and out-of-round is 0.0013 inches — out-of-round exceeds specification

C. Taper is 0.0017 inches and out-of-round is 0.0005 inches — taper is within specification but boring is needed

D. Taper is 0.0025 inches and out-of-round is 0.0005 inches — taper exceeds specification

31. A customer reports that the engine has developed a noticeable vibration at idle that was not present six months ago. The vibration is felt through the steering wheel and seats. At any RPM above 1,000, the vibration disappears completely. No misfires are indicated on the scan tool. Compression is within specification on all cylinders. Engine mounts appear intact. Which of the following should the technician investigate FIRST?

A. The idle speed RPM to verify it has not dropped below the manufacturer's specification since the last service

B. The crankshaft harmonic balancer for internal rubber deterioration that no longer damps idle vibrations

C. The catalytic converter for an internal rattle that resonates at the specific idle frequency of the engine

D. The torque converter for a lock-up clutch that is partially engaging at idle and creating drivetrain vibration

32. A technician discovers during a rebuild that the engine block has been bored 0.040 inches oversize previously — the maximum recommended oversize. A compression check before teardown showed one cylinder significantly lower than the others. After cleaning the block, that cylinder shows no visible defects. However, bore measurement reveals that cylinder is 0.002 inches larger than the other 0.040-oversize bores from additional wear since the previous rebuild. Which of the following is the correct repair for this cylinder?

A. Hone the cylinder and install the same 0.040-oversize rings with a slightly wider ring end gap

B. Bore all cylinders to 0.060-inch oversize despite exceeding the manufacturer's maximum limit

C. Install a new piston with a slightly larger skirt diameter to compensate for the additional bore wear

D. Install a cylinder sleeve to restore the bore to standard or a smaller oversize dimension

33. An engine with a known history of extended oil change intervals (changed every 15,000 miles instead of the specified 5,000) has developed a persistent ticking noise from the valvetrain. Oil pressure is within specification. The technician removes the valve cover and discovers heavy sludge deposits coating the rocker arms, cam followers, and cam journals. Which of the following is the MOST likely mechanism by which sludge is causing the ticking?

A. The sludge is reducing oil viscosity in the valvetrain area and thinning the oil film at the lash adjuster

B. Sludge is clogging the oil feed passages to one or more hydraulic lash adjusters, preventing them from filling

C. The sludge deposits are physically interfering with rocker arm movement and limiting its travel range

D. Sludge on the cam lobes is increasing the effective cam lift and pushing the valves open further than designed

34. A technician performs a cylinder leak-down test on a four-cylinder engine after a customer complaint of coolant loss with no external leaks. Results are: Cyl 1 = 6%, Cyl 2 = 7%, Cyl 3 = 25%, Cyl 4 = 5%. During the cylinder 3 test, the technician observes small but steady bubbles in the coolant recovery tank. No air is heard at the tailpipe, intake, or oil filler cap on cylinder 3. Which of the following does this specific pattern of findings indicate?

A. Cylinder 3 has a cracked exhaust valve that is leaking compression into an exhaust port with a coolant crack

B. Cylinder 3 has a head gasket breach that is leaking compression exclusively into a coolant passage

C. Cylinder 3 has a cracked block wall between the cylinder bore and an adjacent coolant passage

D. The test is inconclusive because the only leakage path detected is to the coolant without ring or valve involvement

35. A vehicle with a four-cylinder naturally aspirated engine is brought in with a complaint that fuel economy has gradually decreased by approximately 20% over the past year. The engine runs smoothly with no misfires. A compression test shows all cylinders between 125 and 132 PSI — below the 145 to

165 PSI specification. A vacuum gauge reads 15 in. Hg at idle. The engine has 195,000 miles. Which of the following BEST explains how the low compression is causing poor fuel economy?

A. Reduced compression lowers combustion efficiency, requiring more fuel to produce the same power output

B. Low compression causes the engine to run lean, which triggers the PCM to add unnecessary fuel enrichment

C. The worn rings allow excessive blowby that contaminates the intake charge through the PCV system

D. Low compression reduces exhaust temperature, preventing the catalytic converter from operating efficiently

36. A technician is preparing to install a replacement oil pump on a rebuilt engine. The new pump came with a new pickup tube and screen. After installing the pump and temporarily fitting the oil pan, the technician measures the pickup screen-to-pan clearance and finds it is 5/8 inch. The specification is 1/4 to 3/8 inch. Which of the following is the MOST likely cause of the excessive clearance?

A. The replacement oil pump is designed for a different engine application and has a shorter pickup tube

B. The oil pan has been dented from a previous impact and the pan floor sits lower than the original design

C. The pickup tube is the correct part number but needs to be bent slightly to achieve the correct clearance

D. The block mounting surface for the oil pump has residual gasket material raising the pump away from the block

37. A technician is testing a vehicle's charging system after an engine repair. With the engine running at 2,000 RPM and headlights on, the voltmeter across the battery terminals reads 15.2 volts. The specification for this vehicle is 13.5 to 14.8 volts. Which of the following does this reading indicate?

A. The charging system is operating at the upper edge of normal and no action is required at this time

B. The battery is deeply discharged and the alternator is producing a higher initial charge rate to recover

C. The headlights are drawing insufficient current, which artificially elevates the voltage reading higher

D. The alternator voltage regulator is faulty and the system is overcharging, which can damage the battery and electronics

38. A vehicle with a V8 engine exhibits a condition where the engine runs perfectly when cold but develops a random misfire (P0300) after reaching full operating temperature. Compression is within specification on all cylinders at both cold and hot conditions. The misfire is not isolated to any single cylinder — it moves between cylinders randomly. Which of the following is the MOST likely cause?

A. Worn piston rings on all cylinders that only lose their seal after the oil thins at operating temperature

B. A failing crankshaft position sensor that produces signal errors only when heat-soaked after warm-up

C. An intake manifold gasket that develops a vacuum leak only when the manifold expands at operating temperature

D. Worn valve stem seals on multiple cylinders that leak oil onto the plugs only when the engine is hot

39. Technician A says that an engine block should be checked for main bearing bore alignment during every rebuild regardless of the engine's service history. Technician B says that main bearing bore alignment only needs to be checked if the engine has a known history of overheating or main cap fretting. 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

40. A technician is diagnosing a vehicle that produces a loud knocking noise from the engine only during the first 3 to 5 seconds of cold start. The noise is heavy, rhythmic, and comes from the lower engine area. It disappears completely after 5 seconds and does not return at any temperature or load. Oil level and viscosity are correct. Oil pressure reaches 40 PSI within the first second of starting. Which of the following is the MOST likely cause?

A. Main bearing wear that closes up once the oil film is established in the bearing clearance at startup

B. Piston pin (wrist pin) knock from cold clearances that close as the piston and pin warm and expand

C. Crankshaft thrust bearing wear that produces a knock from axial movement during torque converter load

D. Rod bearing wear that produces a momentary knock until oil pressure fills the worn clearance gap

41. A technician is performing a valve adjustment on a DOHC engine with solid (mechanical) valve lifters using shim-over-bucket adjusters. The specification for the exhaust valves is 0.010 to 0.012 inches. The technician measures the number 3 exhaust valve clearance at 0.015 inches. The shim currently installed is 2.50 mm thick. Which of the following shim thicknesses would bring the clearance closest to the middle of the specification?

A. A 2.40 mm shim, which would reduce the clearance by approximately 0.004 inches to 0.011 inches

B. A 2.45 mm shim, which would reduce the clearance by approximately 0.002 inches to 0.013 inches

C. A 2.55 mm shim, which would increase the clearance by approximately 0.002 inches to 0.017 inches

D. A 2.58 mm shim, which would decrease the clearance by approximately 0.003 inches to 0.012 inches

42. An engine that has been running for 25,000 miles since a rebuild develops a sudden onset of blue exhaust smoke at all operating conditions. Oil consumption jumps from near-zero to one quart per 500 miles within a single week. Compression is still within specification on all cylinders. Oil pressure is normal. Which of the following is the MOST likely cause of this sudden onset?

A. Gradual ring wear that has finally reached a critical point where sealing has failed dramatically

B. A failed PCV valve stuck in the full-open position that is drawing excessive crankcase oil into the intake

C. Worn valve stem seals that have simultaneously deteriorated on multiple cylinders from age and heat

D. A broken oil control ring on one cylinder that suddenly lost its tension and is allowing oil past the pack

43. A technician is replacing the rear main seal on an engine. After removing the transmission and flywheel, the technician discovers that the seal housing surface on the block has a small chip in the aluminum casting approximately 1/8 inch wide at the seal's outer diameter sealing surface. Which of the following is the correct action?

A. Clean the chipped area, apply anaerobic sealant to the damaged section, and install the new seal

B. Fill the chip with a two-part metallic epoxy, sand it smooth after curing, and then install the new seal

C. Install the seal offset slightly from the chip so the seal lip rides on an undamaged section of the bore

D. Replace the rear seal housing because the chip compromises the seal's ability to maintain contact

44. Technician A says that during a leak-down test, the regulated supply pressure should always be set to exactly 100 PSI for consistent and comparable results. Technician B says that some leak-down testers use different regulated supply pressures and the results must be interpreted according to the specific tester's scale and instructions. Who is correct?

A. Both Technician A and Technician B

B. Technician A only

C. Neither Technician A nor Technician B

D. Technician B only

45. A vehicle with a known rod bearing knock on cylinder 4 is being evaluated for repair cost versus replacement. During teardown, the technician discovers that the crankshaft rod journal for cylinder 4 is severely scored and heat-discolored. The journal measures 0.015 inches below standard specification. The maximum undersize regrind is 0.030 inches. However, the technician also discovers that main journals 3 and 4 both show slight discoloration and measure 0.003 inches below standard — technically within the standard tolerance range. Which of the following is the MOST appropriate recommendation?

A. Regrind only the number 4 rod journal and reuse the main journals with standard bearings

B. Regrind the number 4 rod journal and closely monitor the main journals by checking clearance with Plastigage

C. Replace the crankshaft because the main journal discoloration indicates the entire crank was oil-starved

D. Regrind the number 4 rod journal to undersize and also regrind main journals 3 and 4 to the first undersize as a precaution

46. A technician performs a cooling system pressure test on a vehicle with a suspected heater core leak. The system holds 15 PSI for 20 minutes with no drop. The customer insists there is a sweet coolant smell inside the vehicle. The floor carpets are dry. Which of the following should the technician do NEXT?

A. Tell the customer the system holds pressure and there is no leak anywhere in the cooling system

B. Inspect the evaporator drain and A/C system for mold or bacterial growth that can produce sweet odors

C. Turn the heater to full hot, run the blower on high for 10 minutes, and then reinspect for any moistness or smell inside the HVAC housing and on the carpet

D. Replace the heater core as a precaution because a sweet smell always indicates a coolant leak

47. A freshly rebuilt engine exhibits normal oil pressure at idle (30 PSI) but the pressure drops to 20 PSI when the engine is revved to 3,000 RPM. Normal behavior would be for pressure to increase with RPM. Oil level and viscosity are correct. Which of the following is the MOST likely cause of this abnormal pressure behavior?

A. The oil pump drive gear is slipping on its shaft and loses engagement at higher rotational speeds

B. A main bearing cap was left loose and the bearing bore distorts at higher RPM from centrifugal force

C. The oil pressure relief valve is opening at too low a pressure setting and dumping oil back to the pan

D. An oil gallery plug was left out during assembly and oil is escaping from the unplugged gallery at higher flow

48. Technician A says that an engine that has been hydrostatic-locked from coolant filling a cylinder should have the spark plugs removed and the engine cranked to expel the liquid before any further action. Technician B says that forcing a hydro-locked engine to rotate with a breaker bar is acceptable because the liquid will compress eventually. 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

49. An engine with a DOHC design develops a check engine light with code P0022 (intake camshaft position timing over-retarded, bank 2). The engine exhibits poor low-end torque and a rough idle. The oil level is correct and the oil was changed recently with the manufacturer-specified full synthetic. The oil control valve (VVT solenoid) for bank 2 intake cam was replaced, but the code returned after 50 miles. Which of the following should the technician investigate NEXT?

A. The timing chain stretch on bank 2 that may have altered the base camshaft-to-crankshaft relationship

B. The PCM software calibration for bank 2 intake cam timing that may require a reflash update

C. The exhaust camshaft position sensor on bank 2 that may be cross-referencing incorrect data to the PCM

D. The cam phaser itself on the bank 2 intake cam for internal wear or mechanical failure

50. A vehicle owner reports that the engine makes a single loud pop from the exhaust when the ignition is turned off after highway driving. The engine runs perfectly otherwise. No codes are stored. Which of the following is the MOST likely cause?

A. A burned exhaust valve that allows unburned fuel to escape into the hot exhaust on shutdown

B. An exhaust manifold crack that allows air to enter and ignite residual fuel vapor on shutdown

C. A slightly rich idle mixture that leaves unburned fuel in the exhaust which ignites from residual heat

D. A failing catalytic converter that stores excessive heat and spontaneously ignites exhaust gas on shutdown

Practice Exam 11: 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 plus 15% on bank 2 only, with normal compression on all bank 2 cylinders, indicates the PCM is adding 15% more fuel to compensate for a lean condition isolated to that bank. [A] A vacuum leak at the bank 2 intake manifold runner or gasket introduces unmetered air that leans the mixture on only that bank. Worn rings would show compression loss, not elevated fuel trim with normal compression. A fuel pump issue would affect both banks equally since they share the same fuel rail.

2. A — Two adjacent cylinders with very low compression (45 PSI each) while the other two cylinders are normal, on an interference engine at 80,000 miles since timing belt replacement, is the classic pattern of a timing belt that has jumped teeth. [A] When the belt jumps on an interference engine, the mistimed

valves are struck by the pistons, bending them so they cannot close. The bent valves on cylinders 1 and 2 produce catastrophically low compression. Simultaneous head gasket failure or detonation damage on exactly two adjacent cylinders is far less likely than a timing belt failure.

3. C — Blue exhaust haze under boost only — with no smoke at idle or deceleration, normal compression, no turbocharger shaft play, and a clear drain line — points to a combustion chamber sealing issue that manifests only under the elevated cylinder pressures of boosted operation. [A] Low-speed pre-ignition (LSPI) is a known phenomenon in turbocharged GDI engines where abnormal combustion events can damage piston ring lands, creating subtle ring seal failures that only manifest under boost pressures. Valve stem seal leaks would produce smoke at deceleration (high vacuum), and turbo seal leaks would produce smoke at idle as well.

4. D — Cylinder 3 with 15% leakage and air only at the oil filler cap has moderate ring wear — a straightforward finding. [A] Cylinder 4 with 18% leakage has air at both the oil filler cap (ring wear) AND bubbles in the coolant (head gasket breach to a coolant passage). Cylinder 4 has two separate leak paths — worn rings allowing some air past into the crankcase, and a minor gasket breach allowing some air into the coolant. The two findings on cylinder 4 represent two independent conditions, not a single failure.

5. B — A valvetrain tick on a specific cylinder of a newly rebuilt OHV engine, with a verified-functional lifter and a new camshaft, should first be investigated at the pushrod — the component most likely to be incorrect in a rebuild where multiple parts were sourced. [B] Pushrods come in various lengths depending on the application, and if the replacement pushrod for the number 2 exhaust position is slightly too short or too long, it alters the geometry of the rocker arm-to-valve interface, creating a ticking noise. Verifying pushrod length against the manufacturer's specification is a quick, non-invasive check.

6. A — Both technicians are correct. [A] A 2.0-liter four-cylinder engine has a swept volume of 500 cc per cylinder (2000 ÷ 4 = 500). The total cylinder volume at BDC includes the swept volume plus the combustion chamber volume: if the compression ratio is 10:1, then total volume ÷ combustion chamber volume = 10, meaning combustion chamber volume = total volume ÷ 10. With swept volume of 500 cc, total volume is approximately 555.5 cc, and combustion chamber volume is approximately 55.5 cc. However, the question states 200 cc total and 22 cc chamber — Technician A's 200 cc per cylinder as "total volume at BDC" is approximately correct for the swept volume portion (500/2.5 rough approximation), and Technician B's 22 cc combustion chamber yields a ratio consistent with 10:1 when applied to the stated volumes. Both calculations are internally consistent.

7. C — A rhythmic clicking from the crankshaft pulley area on a harmonic balancer that appears visually intact should be investigated for a loose crankshaft pulley-to-balancer bolt or a loose balancer-to-crankshaft fit. [A] If the harmonic balancer bolt has loosened, the balancer can rock or shift microscopically on the crankshaft snout with each revolution, producing a rhythmic click at crankshaft frequency. The balancer may appear intact because the rubber bonding is fine — the looseness is at the bolt interface, not the rubber layer.

8. A — The head has 0.004 inches of warpage and is 0.006 inches above minimum thickness. [B] Resurfacing to remove the full 0.004 inches of warpage leaves 0.002 inches above the minimum — technically still within specification. While this is a thin margin, it is acceptable because the head has not yet reached minimum thickness. Removing only 0.003 inches (option D) would leave 0.001 inches of residual warpage, which exceeds the specification and would not seal properly with an MLS gasket.

9. D — Switching to a heavier viscosity oil will temporarily increase oil pressure readings because the thicker oil flows less easily through the worn bearing clearances, creating more resistance and therefore more measurable pressure. [D] However, the heavier oil does not repair the worn bearing surfaces — the metal-to-metal damage remains. The knock may diminish slightly because the thicker oil film better cushions the impact, but this is a temporary mask, not a repair. The bearings will continue to deteriorate, and the heavier oil may also reduce flow to the upper valvetrain.

10. B — All findings point to the same root cause: uniformly low compression across all cylinders (115–125 versus 145–165 specification), a steady low vacuum reading (15 in. Hg versus normal 17–21), wet test improvement on all cylinders (confirming rings), and oil consumption of one quart per 1,200 miles at 185,000 miles. [A] This is the complete picture of generalized ring and bore wear throughout a high-mileage engine. No single catastrophic failure exists — the entire engine has worn uniformly beyond its designed operating specifications.

11. C — An engine that runs normally during a 10-minute shop warm-up but overheats on the highway the next day, with a coolant level drop and an air pocket found at the bleeder screw, confirms that trapped air from the initial fill was not fully purged. [D] At highway speed, the higher coolant temperatures and flow rates cause the trapped air to expand and migrate, creating hot spots where the air pocket displaces liquid coolant from contact with the cylinder walls and head. Re-bleeding the system to purge the remaining air resolves the intermittent overheating.

12. D — An engine that surges at highway cruise with no codes after an intake manifold gasket replacement at another shop strongly suggests a vacuum hose was left disconnected or misrouted during the reassembly. [A] The timing coincidence — the surge appeared immediately after the gasket service — makes a service-related error far more likely than a coincidental component failure. A disconnected

vacuum hose creates an unmetered air leak that the PCM's fuel trim system chases, producing the characteristic RPM hunting pattern.

13. B — A lifter bore that is scored and enlarged beyond the standard lifter diameter requires boring to the next oversize and installation of a matching oversize-diameter lifter. [C] This restores the proper clearance between the lifter and bore, ensuring the lifter maintains alignment with the cam lobe and receives adequate oil flow. Metallic epoxy is not a reliable repair for a precision bore that experiences continuous reciprocating motion and oil pressure.

14. A — The most effective first approach for broken exhaust studs flush with the head surface is to center-drill the stud, then drill with a left-hand drill bit. [B] Left-hand drill bits rotate counterclockwise, and the cutting action sometimes catches the stud and unscrews it as the bit advances — removing the stud without needing an extractor. If the stud does not unscrew during drilling, a screw extractor (EZ-Out) is inserted into the drilled hole to turn the stud out. This sequential approach maximizes success while minimizing the risk of further damage.

15. D — A P0299 underboost code with boost reaching only 8 of the specified 18 PSI, no exhaust leaks, and a functional wastegate actuator points to pressurized charge air escaping between the compressor and the engine. [A] A boost leak in the intercooler piping, a cracked intercooler hose, a loose clamp, or a ruptured intercooler allows the compressed air to escape before it reaches the intake manifold. The turbocharger is producing boost but the pressurized air is lost downstream, preventing the specified boost from reaching the engine.

16. C — Neither technician describes a universally correct approach because main bearing cap torque sequences vary by manufacturer and engine design. [C] Some manufacturers specify center-outward sequences, others specify front-to-rear, and some use unique patterns based on the block's structural characteristics. The only correct approach is to follow the specific torque sequence published in the manufacturer's service information for that engine. Applying a generic rule risks uneven clamping force and potential bore distortion.

17. A — Oil pressure readings of 20 PSI at idle and 42 PSI at 2,500 RPM are both within the manufacturer's specifications (minimum 15 at idle, 40–65 at speed). [D] The decrease from the 500-mile break-in values (30 PSI idle, 55 PSI at speed) to the current values over 15,000 miles represents normal progressive bearing wear-in. New bearing surfaces undergo a controlled wear process that slightly increases clearances from their as-assembled dimensions. The rate of decrease will decelerate as the bearings reach their equilibrium running clearance.

18. B — A metallic grinding sound that occurs only during cranking and stops the instant the engine fires points to the starter drive mechanism. [E] The most common cause is the starter drive (Bendix) not fully disengaging from the flywheel ring gear after the engine starts — the overrunning clutch in the starter drive is failing, causing the spinning ring gear to drive the starter pinion momentarily until the overrunning clutch releases. A worn flywheel ring gear with damaged teeth can also cause grinding at the specific tooth location where the starter engages.

19. D — Very low compression on a single cylinder (108 PSI) with minimal improvement on the wet test (to 112 PSI — only 4 PSI increase) and air heard at the intake manifold during the leak-down test confirms the intake valve is not sealing. [A] The wet test rules out rings as the primary cause — if rings were the problem, the oil would have sealed the gap and raised the reading significantly. The air at the intake confirms the specific leak path: compressed air passes from the combustion chamber past the unsealed intake valve, through the port, and into the intake manifold.

20. A — An engine that overheats at a long idle in traffic but cools immediately when the vehicle begins moving receives adequate cooling from ram airflow at speed but not from the electric cooling fan at idle. [D] The pressure test and block test have ruled out leaks and head gasket failure. The next logical step is to verify whether the cooling fan is actually activating when the temperature rises — the fan motor, relay, temperature sensor, wiring, and PCM command should all be tested under the actual high-temperature conditions that trigger the complaint.

21. C — A hairline crack at a fillet radius on a crankshaft journal is a fatigue failure that will inevitably propagate under the cyclic loading of engine operation. [C] Fillet radii are the highest-stress points on the crankshaft because they are the transition zones where bending and torsional forces concentrate. A crack at this location — regardless of how small — represents a metallurgical failure that cannot be repaired by regrinding or polishing. The crankshaft must be replaced to prevent catastrophic failure during operation.

22. B — The incorrect 10W-40 conventional oil is significantly thicker than the manufacturer-specified 0W-20 full synthetic, and this thickness directly affects VVT system operation. [A] VVT oil control valves and cam phasers rely on precise oil flow through very fine internal passages and screens to achieve commanded camshaft positions. Oil that is too thick flows too slowly through these passages, preventing the phaser from reaching the PCM's commanded position within the expected time window, triggering the P0011 over-advanced code.

23. D — The head passes all post-machining tests: pressure testing shows no coolant leaks, and dye penetrant inspection reveals no cracks. [B] The gasket failure between the combustion chamber and oil passage, and the external coolant weep, were caused by the gasket failing — not by a head defect. The

resurfaced head, having passed both leak and crack tests, is suitable for reinstallation. The gasket failure was likely caused by the underlying overheating event that initiated the repair, not by a crack in the head.

24. A — Technician B only is correct: valve guide wear must be characterized by measuring the bore at three heights (top, middle, bottom of the guide) in two perpendicular directions at each height. [B] This six-point measurement matrix reveals the full wear pattern — including bell-mouth wear at the top and bottom where the valve stem reverses direction. Measuring only at the center (as Technician A suggests) misses the most worn areas and can lead to declaring a guide serviceable when it is actually worn beyond specification at the ends.

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25. B — A faint blue-white smoke from the tailpipe that appeared immediately after a head gasket replacement and was not present before is most likely caused by assembly lubricant, oil residue, or small amounts of oil that entered the combustion chambers during the head installation process. [A] During head removal and installation, oil from the valve cover area, cam journals, and oil passages can drip into open cylinders. This residual oil burns off during the first minutes of operation, producing a temporary haze that clears as the combustion chambers clean themselves. If the smoke persists beyond 15 to 20 minutes, further investigation is warranted.

26. C — An exhaust cam lobe that has lost 0.020 inches of lift on one cylinder means the exhaust valve on that cylinder opens 0.020 inches less than designed, restricting the cylinder's ability to expel combustion gases during the exhaust stroke. [B] The trapped exhaust gas dilutes the incoming fresh charge on the next intake stroke, reducing the cylinder's power output. This can produce a subtle misfire or roughness on the affected cylinder, particularly at lower RPMs where the reduced valve opening has the greatest proportional impact on gas flow. At higher RPM, the increased gas velocity partially compensates.

27. D — A crankshaft that does not sit evenly in the saddles after the upper bearing shells are installed — with one end 0.010 inches higher than the other — indicates a bearing shell mismatch at one of the journal positions. [C] If an upper shell intended for a different saddle position (with a different wall thickness due to selective-fit sizing) was placed in the wrong location, the journal sits higher or lower than its neighbors. The technician must verify that every upper bearing shell matches the correct saddle position per the manufacturer's selective-fit chart.

28. A — Technician A only is correct: the camshaft rotates at exactly half the crankshaft speed, so at 6,000 RPM crankshaft speed, the camshaft turns at 3,000 RPM. [A] Technician B is wrong about the firing frequency: on a four-stroke engine, each cylinder fires once every two crankshaft revolutions. At 6,000 RPM, there are 3,000 firing events per minute for the entire four-cylinder engine — but each individual cylinder fires only 1,500 times per minute (6,000 ÷ 2 ÷ 2 = 1,500 for a 4-cylinder, since there are two revolutions per cycle).

29. B — An engine that stalls when the brake pedal is pressed firmly, appeared after a brake service, and restarts immediately when the brake is released points to a vacuum leak associated with the brake booster system that was disturbed during the service. [A] The most common cause is the brake booster vacuum hose being left disconnected or kinked during the brake work. When the pedal is pressed, the booster diaphragm opens to atmospheric pressure through the disconnected hose, creating a massive vacuum leak at the intake manifold that overwhelms the fuel system and stalls the engine.

30. C — Taper is calculated from the largest to smallest measurement in the same direction: perpendicular readings show 3.5025 (top) minus 3.5008 (bottom) = 0.0017 inches. [C] Out-of-round is the difference between perpendicular readings at the same height: at the top, 3.5025 minus 3.5020 = 0.0005 inches. Taper of 0.0017 is within the 0.002 maximum specification, and out-of-round of 0.0005 is within the 0.001 maximum. Both measurements are within specification, so the bore can be honed and reused with standard-size rings.

31. A — An idle vibration felt through the steering wheel and seats that disappears above 1,000 RPM, with no misfires and normal compression, should first be checked at the most basic level — the actual idle RPM. [A] If the idle speed has dropped below the manufacturer's specification (due to a carbon-coated throttle body, a dirty IAC valve, or a PCM adaptation issue), the engine operates at a speed where its natural vibration harmonics are not adequately damped by the engine mounts. Restoring the correct idle speed often eliminates the vibration without any further diagnosis.

32. D — The cylinder has already been bored to the maximum recommended 0.040-inch oversize and has worn an additional 0.002 inches beyond that dimension. [C] Boring further to 0.060 oversize exceeds the manufacturer's maximum and risks making the cylinder wall too thin for safe operation. The correct repair is to install a cylinder sleeve — a precision-machined tube pressed into the bored-out cylinder that restores it to standard bore diameter (or any desired oversize) with a new, unworn surface.

33. B — Sludge clogging the oil feed passages to hydraulic lash adjusters prevents pressurized oil from reaching the adjusters' internal chambers. [D] Without oil pressure, the adjuster cannot pump up and maintain zero lash — it collapses, creating clearance between the cam lobe and the follower that produces the characteristic ticking noise. The sludge does not change oil viscosity locally or physically

interfere with rocker arm movement — it specifically blocks the narrow oil passages that feed the adjusters.

34. B — Cylinder 3 with 25% leakage and bubbles in the coolant — but no air at the tailpipe, intake, or oil filler cap — indicates the sole leak path is from the combustion chamber directly into a coolant passage through the head gasket. [A] The absence of air at the exhaust or intake confirms both valves are sealing. The absence of air at the oil filler cap confirms the rings are sealing. The only exit path for the compressed air is into the cooling system, confirming a head gasket breach exclusively between the cylinder 3 combustion chamber and an adjacent coolant passage.

35. A — Lower compression directly reduces the engine's thermodynamic efficiency — less work is extracted from each combustion event because the lower compression ratio produces less pressure acting on the piston during the power stroke. [A] To maintain the same vehicle speed and driving performance, the driver unconsciously opens the throttle further, commanding more fuel. The engine must burn more fuel to produce the same net power output because each combustion cycle is less efficient. Over time, this manifests as a measurable decrease in fuel economy.

36. C — The pickup tube is the correct part number for this application, but the screen-to-pan clearance of 5/8 inch exceeds the 1/4 to 3/8-inch specification. [D] Some replacement pickup tubes require minor bending to achieve the correct clearance for the specific pan geometry. The technician should carefully bend the pickup tube downward to bring the screen within the specified 1/4 to 3/8-inch distance from the pan floor, then verify the clearance with the pan temporarily installed before final assembly.

37. D — A charging system voltage of 15.2 volts exceeds the maximum specification of 14.8 volts, confirming the alternator is overcharging. [E] The voltage regulator — either internal to the alternator or controlled by the PCM — has failed and is not limiting the alternator's output. Sustained overcharging at 15.2 volts accelerates battery water consumption (electrolyte boiling), damages electronic control modules, burns out light bulbs prematurely, and can overheat the battery to the point of failure. The alternator or its voltage regulator must be repaired or replaced immediately.

38. C — A random misfire that appears only at operating temperature, with normal compression at both cold and hot conditions and no single cylinder isolation, points to a heat-dependent air leak. [A] An intake manifold gasket that seals adequately when cold but develops a vacuum leak as the manifold and head expand at operating temperature introduces unmetered air that randomly affects whichever cylinders are nearest to the leak. The random nature (P0300 rather than a cylinder-specific code) confirms the lean condition affects multiple cylinders variably.

39. A — Technician A only is correct: main bearing bore alignment should be checked during every rebuild regardless of service history because bore alignment can be affected by factors that leave no externally visible evidence. [C] Undetected overheating events, improper previous assembly, cap fretting from normal operation, and even block distortion from head bolt torque can all affect bore alignment. Verifying alignment with an alignment bar is a quick check that catches problems before they destroy a freshly rebuilt engine's bearings.

40. B — A heavy rhythmic knock from the lower engine during the first 3 to 5 seconds of cold start that disappears completely and never returns matches piston pin (wrist pin) knock from cold clearances. [A] When the engine is cold, the piston and wrist pin have not yet expanded to their operating dimensions, and the clearance between the pin and the piston bore or connecting rod small-end bushing is at its widest. The loose pin produces a heavy knock during each piston direction change. Within seconds, heat from combustion expands the components and closes the clearance gap, silencing the knock.

41. D — The current clearance is 0.015 inches and the specification midpoint is 0.011 inches, so the clearance needs to decrease by 0.004 inches. [B] Installing a thicker shim decreases clearance because the thicker shim pushes the bucket closer to the cam lobe. The required shim thickness is 2.50 mm + 0.004 inches (approximately 0.10 mm) = approximately 2.60 mm. A 2.58 mm shim would reduce the clearance by approximately 0.08 mm (≈0.003 inches) from 0.015 to approximately 0.012 inches — within the 0.010 to 0.012 specification.

42. B — A sudden onset of blue smoke at all operating conditions within a single week — on an engine that previously had near-zero oil consumption — points to a discrete failure event rather than gradual wear. [D] A PCV valve stuck in the full-open position creates excessive vacuum in the crankcase, pulling oil vapor and liquid oil mist into the intake manifold at all times. This abrupt change from normal to severe oil consumption matches the sudden nature of a PCV valve failure, whereas gradual ring or seal wear would produce a progressive worsening over months.

43. B — A chip in the seal housing bore at the rear main seal's outer diameter sealing surface creates a gap that the seal cannot bridge, allowing oil to leak past. [C] The most appropriate repair is to fill the chip with a two-part metallic epoxy (such as JB Weld), allow it to fully cure, and then sand the repair smooth and flush with the surrounding bore surface. This restores the flat, continuous surface that the seal's outer diameter requires to maintain contact. Sealant alone is insufficient for a dynamic seal interface.

44. A — Both technicians make valid points. [A] Technician A is correct that 100 PSI is the standard regulated supply pressure used on most common leak-down testers, and using a consistent supply pressure is essential for comparable results between tests. Technician B is also correct that not all testers

are identical — some use different supply pressures or gauge configurations, and the results must be interpreted according to that specific tester's calibration and instructions.

45. D — The number 4 rod journal requires regrinding to an undersize to clean up the severe scoring — this is straightforward. [C] The main journals 3 and 4 showing discoloration is a warning sign that they were also exposed to insufficient lubrication during the event that destroyed the number 4 rod bearing. While they measure within standard tolerance, the discoloration indicates the oil film was lost momentarily, and subsurface metallurgical damage may have occurred. Regrinding these journals to the first undersize and installing fresh bearings provides insurance against a delayed main bearing failure.

46. C — A pressure test that holds steady does not rule out a heater core leak if the leak is intermittent or too small to register on the gauge. [D] The sweet smell reported by the customer is a strong indicator of coolant vapor. The most effective way to provoke a small heater core leak is to run the heater at full hot with maximum blower speed for an extended period, which maximizes coolant flow and temperature through the core. After 10 minutes, inspecting the HVAC housing interior, evaporator drain, and carpet for any moisture or increased smell can confirm or rule out the leak.

47. C — Oil pressure that drops when RPM increases (the opposite of normal behavior) indicates oil is being diverted from the system at a rate that increases with engine speed. [D] The oil pressure relief valve is the most likely cause — if it is opening at too low a pressure setting (weak spring or debris holding it partially open), it dumps increasing volumes of oil back to the pan as pump output rises with RPM. At idle, the pump output is low enough that the relief valve has minimal effect, so pressure reads normally. At higher RPM, the valve diverts proportionally more oil, causing the paradoxical pressure drop.

48. A — Technician A only is correct: the safe approach to a hydro-locked engine is to remove the spark plugs and crank the engine with the starter to expel the liquid from the cylinder through the plug holes. [A] Technician B is dangerously wrong: liquid is essentially incompressible, and forcing a hydro-locked engine to rotate with a breaker bar applies extreme force to the connecting rod, which can bend the rod, crack the piston, or damage the crankshaft. The liquid must be expelled before any rotation is attempted.

49. D — A P0022 (intake cam over-retarded) code on bank 2 that returns after replacing the oil control valve, with correct oil specification and recent oil change, indicates the VVT solenoid was not the root cause — the issue is mechanical within the cam phaser itself. [B] The cam phaser on the bank 2 intake camshaft likely has internal wear — worn vane seals, scored bore, or a damaged locking pin — that prevents it from reaching and holding the commanded advanced position. The phaser defaults to or drifts toward the retarded position because the worn internals cannot maintain hydraulic lock.

50. C — A single loud exhaust pop at the moment of key-off shutdown after highway driving, with no other symptoms and no codes, indicates unburned fuel is present in the hot exhaust and ignites when the engine stops. [A] A slightly rich idle mixture delivers more fuel than can be completely combusted during each cycle. The excess accumulates in the hot exhaust manifold and catalytic converter. At key-off, the sudden cessation of exhaust flow allows the residual fuel to ignite from the extreme heat of the exhaust components, producing the characteristic shutdown pop.