PRACTICE EXAM 7: ASE A1 ENGINE REPAIR SIMULATION (50 QUESTIONS)

1. A technician is performing a compression test on a high-mileage V8 engine. The first compression stroke on the gauge for cylinder 6 reads only 40 PSI, but after four additional strokes, the reading builds to 115 PSI. On cylinder 1, the first stroke reads 120 PSI and the final reading after four more strokes is 155 PSI. Which of the following BEST explains the difference in first-stroke behavior between the two cylinders?

A. Cylinder 6 has a burned exhaust valve that delays compression buildup during cranking

B. Cylinder 6 has worn piston rings that require multiple strokes to oil-seal against the bore

C. Cylinder 1 has excessive carbon buildup that falsely elevates its first-stroke reading higher

D. Cylinder 1 has a leaking intake valve that is masked by the rapid subsequent stroke buildup

2. A vehicle owner reports that the engine developed a sudden loss of coolant overnight. The vehicle was parked on a clean concrete garage floor, and no puddle or stain was found beneath the vehicle the next morning. The engine oil on the dipstick appears normal. Which of the following should the technician investigate FIRST?

A. A cracked heater core that may have leaked coolant inside the passenger cabin overnight

B. A failed oil cooler that is allowing coolant to mix with engine oil inside the crankcase

C. An evaporative leak from the radiator cap that released steam overnight as the engine cooled

D. A head gasket breach that allowed coolant to drain into a cylinder while the engine sat

3. A technician notices that during a cold start on a GDI engine with 90,000 miles, the engine shakes noticeably for the first 45 seconds and then smooths out completely. No misfire codes are stored. A borescope inspection of the intake valves reveals heavy carbon deposits on all four intake valves. Which of the following procedures addresses the root cause of this condition?

A. Walnut shell blasting or chemical cleaning to remove the carbon deposits from the valve backs

B. Replacing the fuel injectors with updated high-pressure units that atomize fuel more effectively

C. Installing new spark plugs with a hotter heat range to burn carbon more efficiently in the chamber

D. Performing an intake manifold replacement to improve airflow distribution to the valve surfaces

4. A technician is rebuilding an engine and needs to determine if the cylinder bores can be reused with a hone and standard rings or require boring. The bore measurements for all six cylinders show a maximum taper of 0.0008 inches and a maximum out-of-round of 0.0005 inches. The manufacturer allows 0.002 inches maximum taper and 0.001 inches maximum out-of-round. No scoring or damage is visible. Which of the following is the correct decision?

A. Bore all cylinders to the next oversize because any measurable wear requires fresh machining

B. Replace the engine block because bore measurements below specification indicate casting failure

C. Hone all cylinders to restore the crosshatch pattern and install new standard-size piston rings

D. Bore only the cylinders with the highest taper readings and hone the remaining cylinders

5. A vehicle with a 3.5L V6 engine has an intermittent stalling problem that occurs only when the engine is fully warmed up and idling in Drive with the air conditioning on. The engine restarts immediately each time. Compression, oil pressure, and coolant levels are all normal. Which of the following is the MOST likely cause?

A. A worn camshaft lobe that produces insufficient valve lift at hot idle under accessory load

B. A failing water pump that cannot circulate enough coolant at idle under the A/C heat load

C. Low compression on one cylinder that becomes critical only when the additional load is applied

D. An idle air control or electronic throttle issue that cannot maintain RPM under combined loads

6. Technician A says that when reinstalling an engine after a rebuild, all engine mounts should be inspected for deterioration and replaced if worn. Technician B says that worn engine mounts can cause the engine to shift under load, potentially stretching or disconnecting wiring and hoses. 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 brings in a turbocharged vehicle complaining that the engine has noticeably less power than it did six months ago. The turbocharger spools normally and boost pressure reaches the target specification on the scan tool. There are no diagnostic trouble codes. Exhaust back-pressure is within specification. Which of the following is the MOST likely cause?

A. A wastegate that is opening prematurely and limiting peak boost pressure output

B. A clogged intercooler that is reducing charge air density before it enters the engine

C. A worn turbocharger compressor wheel that cannot maintain consistent boost delivery

D. An exhaust leak upstream of the turbine that is reducing available exhaust energy

8. A technician measures the deck height on an engine block during a rebuild. The measurement from the crankshaft centerline to the block deck surface is 0.005 inches less than the manufacturer's specification. Which of the following BEST explains the significance of this measurement?

A. The block has been previously decked and the pistons may now protrude above the deck surface

B. The reduced deck height means the pistons sit lower in the bore, reducing the compression ratio

C. The measurement indicates the crankshaft main journals are worn and sitting lower in the saddles

D. This is a normal manufacturing tolerance and does not affect engine assembly or performance

9. A technician performs a leak-down test on all four cylinders of an engine with an idle misfire. Cylinders 1, 2, and 4 show 8% leakage each. Cylinder 3 shows 22% leakage with air audible at both the oil filler cap and at the exhaust tailpipe simultaneously. Which of the following conditions could explain air leaking from two locations at the same time on cylinder 3?

A. A head gasket failure between the combustion chamber of cylinder 3 and two adjacent passages

B. A single severely burned exhaust valve combined with a minor crack in the exhaust manifold

C. Worn piston rings combined with an exhaust valve that is not seating fully on cylinder 3

D. A cracked piston crown on cylinder 3 that allows air through the ring pack and valve seats

10. Technician A says that ethylene glycol-based coolant is toxic and must be stored and disposed of according to hazardous material regulations. Technician B says that a coolant spill should be cleaned up immediately because the sweet taste attracts animals that may ingest it. 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

11. A technician is diagnosing a V6 engine that consumes one quart of oil every 1,000 miles. The exhaust shows faint blue smoke at all times — idle, cruise, and acceleration. A compression test shows all cylinders between 115 and 125 PSI. The specification is 145 to 165 PSI. A wet test improves all cylinders by 25 to 35 PSI. Which of the following BEST describes this engine's condition?

A. The engine has worn valve stem seals that are the primary cause of the oil consumption

B. The engine has a PCV system malfunction that is pulling oil into the intake at all speeds

C. The engine has a single failed head gasket that is introducing oil into two combustion chambers

D. The engine has generalized ring and bore wear across all cylinders causing constant oil burning

12. A technician is reinstalling a cylinder head on an engine that uses torque-to-yield head bolts. The manufacturer's procedure calls for an initial torque of 30 ft-lbs on all bolts in sequence, followed by a 90-degree turn on all bolts in sequence, followed by an additional 90-degree turn on all bolts in sequence. The technician performs the initial 30 ft-lbs torque correctly but then applies both 90-degree turns on each bolt individually before moving to the next bolt. Which of the following describes the consequence of this approach?

A. The head gasket will seal more effectively because each bolt reaches full clamping force sooner

B. The procedure is acceptable as long as the total angle applied to each bolt equals the specification

C. The head may warp because clamping force is applied unevenly across the deck surface

D. The bolts will be under-torqued because the two-step angle method requires sequential progression

13. A vehicle with 210,000 miles passes a compression test with all cylinders within 10% of each other and above the manufacturer's minimum. The engine does not burn oil, does not leak, and has no noise complaints. However, the oil pressure at hot idle has gradually decreased from 28 PSI (measured at 150,000 miles) to 18 PSI (measured today). The minimum specification is 15 PSI at idle. Which of the following BEST explains the gradual pressure decline?

A. Normal progressive wear of the main and rod bearings gradually increasing clearances over time

B. The oil pressure relief valve spring has weakened from age and is releasing pressure prematurely

C. The oil pump gears have worn significantly and can no longer generate adequate idle pressure

D. The engine oil passages have accumulated sludge that is restricting flow to the pressure gauge

14. A vehicle's engine cranks at normal speed but fails to start. The technician removes the spark plugs and finds all six plugs wet with raw fuel. The engine has no stored DTCs. Which of the following is the MOST likely reason the engine will not start despite having fuel?

A. The fuel injectors have developed leaks and are flooding the cylinders with excess fuel at rest

B. The ignition system is not producing spark, so the fuel is not being ignited during cranking

C. The fuel is contaminated with water, which prevents it from igniting at normal temperatures

D. The engine timing is so far advanced that the fuel charge is expelled before ignition can occur

15. A customer brings in a vehicle with an inline-4 engine complaining that the engine makes a loud rattling noise from the front of the engine that is constant at all temperatures and engine speeds. The technician removes the timing cover and finds that the timing chain has approximately 1 inch of deflection at the longest span. The specification maximum is 1/2 inch. All of the following components should be replaced EXCEPT:

A. The crankshaft sprocket and the camshaft sprocket that the chain rides on during operation

B. The hydraulic chain tensioner that maintains proper tension on the chain during operation

C. The plastic chain guides that dampen chain vibration and direct chain travel along its path

D. The crankshaft main bearings that support the crankshaft journals inside the engine block

16. A technician is diagnosing an engine that runs normally at idle and light load but misfires under heavy acceleration. A compression test shows all cylinders within specification. Spark plugs show normal wear and coloring. Fuel pressure is within specification at all operating conditions. A close inspection reveals small cracks in the porcelain insulator of the number 2 spark plug that are only visible under magnification. Which of the following explains how this cracked plug causes a load-dependent misfire?

A. The crack allows voltage to flash across the insulator instead of jumping the electrode gap

B. The crack changes the electrode gap dimension under the mechanical stress of engine vibration

C. Under heavy load, higher cylinder pressure increases the voltage needed to fire the plug, and the crack provides an easier path for the spark to short-circuit through the insulator

D. The cracked insulator allows combustion gas to leak past the plug seat and reduce compression

17. Technician A says that a supercharger is driven by the engine's exhaust gases through a turbine wheel connected to a compressor. Technician B says that a turbocharger is driven mechanically by a belt connected to the engine crankshaft. Who is correct?

A. Neither Technician A nor Technician B

B. Technician A only

C. Technician B only

D. Both Technician A and Technician B

18. An engine with 80,000 miles develops a check engine light with code P0420 (catalyst system efficiency below threshold, bank 1). The engine runs normally with no misfires, no oil consumption, and no performance complaints. The upstream oxygen sensor switches normally and the downstream sensor shows minimal switching activity. Which of the following is the MOST likely cause?

A. A burned exhaust valve on bank 1 that is allowing unburned fuel to pass into the converter

B. An exhaust manifold crack that is introducing ambient air and confusing the oxygen sensors

C. A failing upstream oxygen sensor that is providing incorrect data for fuel mixture control

D. A catalytic converter that has lost its conversion efficiency due to age-related catalyst degradation

19. A technician is measuring oil pump gear-to-housing clearance (tip clearance) on a gear-type pump removed during an engine rebuild. The feeler gauge reads 0.007 inches. The manufacturer's specification is 0.003 to 0.005 inches maximum. Which of the following is the correct action?

A. Reinstall the pump because 0.007 inches is within normal operating wear tolerance

B. File the gear tips to remove the wear and restore them to the original tip diameter

C. Replace the oil pump assembly because the clearance exceeds the maximum specification

D. Install a thicker gasket between the pump and the block to reduce the effective clearance

20. A technician is diagnosing an engine noise complaint. Using a stethoscope, a knocking sound is isolated to the number 4 connecting rod bearing area. The technician disables the fuel injector on cylinder 4, but the knock does not change — it remains at the same intensity and rhythm. Which of the following should the technician consider?

A. The knock is definitely from the number 4 rod bearing despite the lack of change when disabled

B. The knock is coming from the main bearing closest to cylinder 4, not the rod bearing itself

C. The stethoscope is transmitting noise from an adjacent cylinder through the block material

D. The knock may actually be from the main bearing nearest to cylinder 4, as main bearing knocks do not change when individual cylinders are disabled

21. A vehicle with a DOHC engine had its timing belt replaced at a reputable shop 5,000 miles ago. The customer now reports that fuel economy has dropped approximately 15% and the engine feels sluggish compared to before the belt service. There are no DTCs, no misfires, and no check engine light. A compression test shows all four cylinders between 115 and 120 PSI. The specification is 145 to 160 PSI. Which of the following is the MOST likely cause?

A. The timing belt was installed one tooth off, slightly retarding the camshaft timing on all cylinders

B. The new timing belt is defective and has stretched enough to change the timing alignment

C. The timing belt tensioner was not tightened to specification and the belt has developed slack

D. The water pump installed during the belt service has a smaller impeller that restricts coolant flow

22. A technician is inspecting the cylinder bores of an engine block and discovers that cylinder 4 has a vertical score line running the full length of the bore. The score is deep enough to feel with a fingernail. All other bores are smooth and undamaged. Which of the following is the MOST likely cause of this scoring?

A. A foreign object that entered the cylinder through the intake port and scratched the bore

B. A manufacturing defect in the cylinder casting that created a stress line during cooling

C. The cylinder wall eroded from coolant leaking into the bore through a porous casting area

D. A broken piston ring end that dragged down the bore wall during engine operation

23. A customer reports that the engine temperature gauge swings between normal and slightly above normal in a rhythmic pattern every 30 to 45 seconds while driving at highway speed. The coolant level is correct and there are no visible leaks. Which of the following is the MOST likely cause?

A. A thermostat that is opening and closing in a cycling pattern from a weak wax element

B. An air pocket trapped in the cooling system that circulates past the temperature sensor

C. A partially clogged radiator that alternately blocks and releases flow through one section

D. A coolant temperature sensor with an intermittent electrical connection causing signal drops

24. Technician A says that a cylinder head can crack between the exhaust valve seats of two adjacent cylinders because this is the thinnest area of the head casting. Technician B says that cracks in this area are usually caused by overheating because exhaust ports experience the highest temperatures. 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

25. A rebuilt engine has been running for 2,000 miles with excellent performance and oil pressure. The customer returns stating that a ticking noise has developed that is loudest at idle and decreases at higher

RPM. The technician verifies correct oil level and viscosity. A stethoscope localizes the noise to the valvetrain area near cylinder 2 on an OHV engine. Which of the following is the MOST likely cause?

A. A hydraulic lifter on cylinder 2 that has developed an internal check valve leak after break-in

B. A cracked rocker arm that is flexing under spring pressure and tapping the valve stem tip

C. A worn pushrod that has developed a slight bend from the repeated load cycling of operation

D. The connecting rod bearing on cylinder 2 is failing and transmitting noise upward to the head

26. A technician is performing a fuel pressure test on a returnless fuel system. With the key on and engine off, the gauge reads 58 PSI, which meets specification. The technician turns the key off and monitors the gauge. The pressure drops to 20 PSI within five minutes. Which of the following does this rapid pressure drop indicate?

A. Normal fuel system behavior because returnless systems are designed to bleed pressure off

B. A weak fuel pump that cannot maintain static pressure in the rail when not running

C. The fuel pressure regulator is venting fuel back to the tank at a rate faster than designed

D. A leaking fuel injector or a faulty fuel pump check valve is allowing pressure to bleed down

27. During an engine rebuild, a technician discovers that the number 3 main bearing bore is 0.002 inches out-of-round when the cap is installed and torqued to specification. All other main bearing bores are within 0.0005 inches of round. Which of the following BEST explains this condition?

A. The number 3 main bearing cap bolts have stretched from the previous installation cycle

B. The number 3 main bearing cap has fretting damage that prevents it from seating properly

C. The block casting has a manufacturing defect that only becomes apparent under cap torque

D. The number 3 main bearing shells are a different thickness than the rest of the bearing set

28. A vehicle with a V6 engine is brought in with a complaint that the heater blows warm air on the passenger side but cool air on the driver side. The engine reaches operating temperature normally and does not overheat. Both heater hoses at the firewall are hot. Which of the following is the MOST likely cause?

A. A blend door actuator malfunction in the HVAC system that is not an engine mechanical problem

B. A partially clogged heater core that is allowing flow through one side but restricting the other

C. An air pocket trapped in the heater core that is blocking coolant on the driver's side passage

D. A thermostat that is sticking intermittently and reducing coolant flow to the heater at times

29. A technician is inspecting a harmonic balancer removed during an engine front seal replacement. The rubber bonding between the inner hub and outer ring appears intact, and the outer ring does not appear shifted. However, when the technician attempts to twist the outer ring relative to the inner hub, it moves approximately 5 degrees before stopping. Which of the following is the correct interpretation?

A. The balancer is in normal condition because a small amount of rotational compliance is designed in

B. The balancer has failed internally and the rubber bond has deteriorated despite appearing intact

C. The movement indicates a manufacturing defect and the balancer should be returned for warranty

D. The rubber has partially separated and the balancer should be replaced to prevent timing mark inaccuracy

30. A technician is assembling a rebuilt engine and discovers that one of the new connecting rod bearing shells has a small nick in its edge near the locating tang. The nick does not extend into the bearing's load-carrying surface area. Which of the following is the correct action?

A. Install the bearing as-is because the nick is outside the load-carrying surface and is non-critical

B. Replace the bearing shell with an undamaged one from a new set to eliminate any risk

C. File the nick smooth to prevent it from interfering with proper bearing shell seating in the bore

D. Install the bearing with the nicked edge facing the cap side where it will be under less load

31. A vehicle with a 4-cylinder engine is brought in after the owner accidentally ran the engine for approximately two minutes with no oil. The engine seized and was towed in. After adding oil, the engine can be rotated by hand but produces a loud knocking noise and very low oil pressure. Which of the following is the MOST likely extent of the damage?

A. Only the oil pump has been damaged from running dry and requires replacement to restore pressure

B. The main and rod bearings have been destroyed from the loss of hydrodynamic oil film support

C. Only the camshaft bearings have failed because they are the furthest components from the pump

D. The cylinder bores are scored beyond repair because the pistons operated without oil film cooling

32. Technician A says that a gasoline direct injection (GDI) engine operates its fuel pump at pressures between 500 and 2,900 PSI. Technician B says that a port fuel injection engine operates its fuel pump at pressures between 35 and 65 PSI. 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

33. A technician is removing a broken exhaust manifold stud from an aluminum cylinder head. The stud has corroded and snapped flush with the head surface. The technician has attempted to use a screw extractor (EZ-Out) but the extractor broke off inside the stud. Which of the following is the MOST appropriate next step?

A. Drill through the broken extractor and stud together using a carbide drill bit to remove both

B. Apply penetrating oil and wait 24 hours, then attempt to remove the extractor with pliers

C. Heat the surrounding aluminum to cherry red to expand the material and loosen the extractor

D. Use a spark eroder (EDM machine) or a specialized broken extractor removal bit to remove it

34. A technician tests the cooling system on a vehicle and finds that the radiator cap releases pressure at 18 PSI. The cap is rated at 16 PSI. Which of the following is the correct interpretation?

A. The cap is releasing pressure too late and may cause cooling system component damage from overpressure

B. The cap is functioning within acceptable tolerance because a 2 PSI variance is insignificant

C. The cap should be replaced because it is not releasing at its rated pressure specification

D. The higher release pressure is beneficial because it raises the coolant boiling point further

35. An engine is being diagnosed for a rough idle that worsens when the A/C is turned on. A vacuum gauge shows 14 in. Hg at idle without A/C and drops to 10 in. Hg with A/C on. The specification calls for a minimum of 15 in. Hg at idle. The compression test shows all cylinders between 125 and 130 PSI, which is at the low end of the 125 to 160 PSI specification. Which of the following conclusions is correct?

A. The A/C compressor is defective and placing an abnormal mechanical load on the engine

B. The engine has marginal compression that becomes insufficient under the additional A/C load

C. The vacuum readings are normal because A/C compressor engagement always reduces vacuum

D. The idle speed control system is defective and not compensating for the A/C compressor load

36. A technician is preparing to install a new oil pump in a rebuilt engine. The pump came with a new pickup tube and screen assembly. Which of the following is the MOST critical measurement during installation?

A. The clearance between the pickup screen and the bottom of the oil pan to ensure proper submersion

B. The alignment of the pump drive shaft with the camshaft or distributor drive gear in the block

C. The thread depth of the pump mounting bolts to ensure they do not bottom out in the block

D. The distance between the pump housing outlet and the main oil gallery entry point in the block

37. A customer reports that the temperature gauge reads slightly higher than normal — approximately three-quarters instead of the usual one-half mark — but the engine has not overheated and no warning lights are on. The coolant level is correct and the system holds pressure. The customer recently had the coolant flushed and refilled at a quick-service shop. Which of the following is the MOST likely cause?

A. The thermostat was not replaced during the flush and is now sticking from disturbed debris

B. The quick-service shop used a coolant type incompatible with the vehicle's cooling system

C. The coolant mixture concentration is incorrect — too much antifreeze relative to water content

D. The radiator was not fully burped during the refill and has a small trapped air pocket

38. A technician is measuring the bore diameter on a cylinder that will be fitted with a new piston. The bore measures 3.5005 inches after honing. The new piston skirt diameter measures 3.4990 inches at the

specified measurement point. The manufacturer's piston-to-bore clearance specification is 0.0010 to 0.0020 inches. Which of the following is the correct assessment?

A. The clearance is excessive and the piston is too small for this bore requiring a different piston

B. The clearance of 0.0015 inches is within specification and the piston is correct for installation

C. The clearance is too tight and the bore should be honed further to increase the bore diameter

D. The clearance of 0.0015 inches is within specification and the components are ready to assemble

39. A vehicle has been in for repeat head gasket failures on the same engine. This is the third head gasket in 18 months. Each time, the head has been resurfaced, a new MLS gasket installed, and new TTY bolts used. The head has been checked for cracks and passes each time. Which of the following underlying causes has MOST likely been overlooked?

A. The head bolt holes in the block have developed thread damage from repeated bolt installations

B. The root cause of the original overheating that initiated the first gasket failure was never corrected

C. The MLS gasket brand being used is not the OEM specification and cannot withstand the pressure

D. The block deck surface has never been checked for warpage and may be distorting the gasket

40. Technician A says that the oil pump creates a fixed volume of oil flow per revolution regardless of system pressure. Technician B says that if the engine bearing clearances are doubled, the oil pump will need to produce twice the volume to maintain the same system pressure. 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

41. A technician is verifying the ring end gap on a new oil control ring expander (the wavy spring that sits behind the two thin rails of the three-piece oil ring assembly). The expander's ends butt together when placed in the bore with zero gap. Which of the following is the correct interpretation?

A. The expander gap must be filed to create a minimum clearance just like the compression rings

B. The expander should be replaced with one from a different ring set that provides end clearance

C. A zero gap or slight overlap on the oil ring expander is normal and within design specification

D. The bore has been honed undersize and the expander is too large for the current bore diameter

42. A technician is road testing a vehicle after a major engine repair and notices a vibration at 2,800 RPM that disappears above and below that speed. The vibration was not present before the repair. The engine runs smoothly on all cylinders with no misfires. Which of the following should the technician investigate FIRST?

A. The crankshaft balance because the rebuilder may have changed the rotating assembly weight

B. The harmonic balancer for damage or incorrect installation during the reassembly process

C. The flywheel or flexplate for a missing balance weight that fell off during engine removal

D. The exhaust system for a hanger that is contacting the underbody at that specific resonance

43. An engine with a single overhead cam and a hydraulic timing chain tensioner develops a rattle from the timing cover area that is present only at idle and disappears above 1,500 RPM. The engine has 175,000 miles. Oil level and pressure are within specification. Which of the following is the MOST likely cause?

A. The timing chain has stretched and the tensioner cannot take up the slack at idle oil pressure

B. The camshaft sprocket has developed a cracked tooth that vibrates only at low chain tension

C. The crankshaft sprocket keyway has worn and the sprocket is rocking on the crankshaft at idle

D. The timing chain tensioner has worn internally and cannot maintain adequate tension at low RPM

44. A technician is performing a parasitic draw test on a vehicle. With the ammeter connected and all modules in sleep mode, the draw reads 65 mA. The specification allows a maximum of 50 mA. The technician begins pulling fuses one at a time. When the fuse labeled "interior lights" is removed, the draw drops to 30 mA. Which of the following is the MOST appropriate next step?

A. Inspect all components on the interior light circuit for a switch or module that is staying on

B. Replace the interior light fuse with a lower amperage fuse to reduce the parasitic current draw

C. Replace all interior light bulbs with LED versions that consume less current when illuminated

D. Disconnect the battery when the vehicle is parked for more than 24 hours to prevent discharge

45. A technician discovers that the cylinder head on a four-cylinder engine has a hairline crack between the number 2 and number 3 exhaust valve seats. The crack is confirmed by dye penetrant inspection. The head is aluminum with pressed-in valve seat inserts. Which of the following is the MOST appropriate repair?

A. Weld-repair the crack using an aluminum TIG welding process and then resurface the head

B. Install thread inserts across the crack to pin it together and prevent further propagation

C. Replace the cylinder head because a crack between valve seats in aluminum cannot be reliably repaired

D. Ignore the crack if a pressure test shows no leakage between the crack and the coolant passages

46. A technician notices during an engine rebuild that the piston cooling jets (oil squirters) on three of four cylinders are aimed correctly at the underside of the pistons, but the jet on cylinder 2 is bent and aims at the cylinder wall instead of the piston. Which of the following is the correct action?

A. Leave the jet as-is because the oil will still reach the piston through splash and runoff

B. Straighten or replace the misaligned jet so it properly directs cooling oil at the piston underside

C. Remove all four jets because they are not essential to engine operation and can be eliminated

D. Bend the other three jets to match the angle of the misaligned jet for uniform spray coverage

47. An engine that was rebuilt 500 miles ago develops a persistent blue haze from the exhaust at all operating conditions. Oil consumption is one quart per 400 miles. A compression test shows all cylinders reading 10 to 15 PSI higher than the pre-rebuild readings. The engine was bored 0.020 inches oversize with new pistons and rings during the rebuild. Which of the following is the MOST likely cause?

A. The oversize pistons are too large and are scuffing the bore walls, generating metallic smoke

B. The new piston rings were installed with incorrect orientation, pumping oil into the chambers

C. The cylinder bores were honed with too fine a finish that prevented the rings from seating properly

D. The piston ring end gaps are too large and are allowing oil and compression past the ring pack

48. Technician A says that an engine coolant leak at the freeze plug can be repaired by driving an expansion-type replacement plug into the freeze plug bore. Technician B says that freeze plugs should be replaced with brass or stainless steel plugs in areas prone to corrosion. 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

49. A customer reports that the engine produces a single loud backfire through the intake manifold during cold start approximately once every two weeks. The engine starts and runs normally otherwise. No codes are stored. All maintenance is current. Which of the following is the MOST likely cause?

A. A fuel injector that intermittently sticks open and floods one cylinder with excess fuel on start

B. A weak ignition coil that occasionally fails to produce adequate spark voltage on cold mornings

C. Momentary valve timing misalignment from a VVT cam phaser that drains oil and repositions slightly

D. A cracked spark plug insulator that randomly short-circuits the spark during the first compression event

50. A technician is investigating an oil consumption concern on a vehicle with 60,000 miles. The engine uses one quart every 3,000 miles. There is no visible smoke at any time, no external leaks, and the PCV system is functioning correctly. Compression and leak-down tests are all within specification. The manufacturer's bulletin states that oil consumption of up to one quart per 2,000 miles is considered normal for this engine. Which of the following is the correct recommendation?

A. Rebuild the engine because any measurable oil consumption indicates an internal wear problem

B. Inform the customer that the oil consumption rate is within the manufacturer's acceptable range

C. Switch to a higher-viscosity oil to reduce the oil consumption rate below the current level

D. Perform additional smoke testing of the exhaust to verify that oil is not being burned invisibly

. Practice Exam 7: 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 first compression stroke that reads very low (40 PSI) but gradually builds over subsequent strokes indicates the piston rings need multiple strokes to establish an oil seal against the bore wall. [A] On a healthy cylinder like cylinder 1, the rings seal well on the first stroke and the gauge jumps to a high initial reading. On cylinder 6, the worn rings cannot seal without the progressive oil film buildup that occurs over multiple cranking strokes. This first-stroke behavior is a key diagnostic clue that differentiates ring problems from valve problems — a burned valve would produce consistently low readings that do not build gradually.

2. D — A sudden overnight coolant loss with no external evidence (no puddle, no floor stain) and normal-appearing engine oil points to coolant draining internally into a combustion chamber through a head gasket breach. [D] When the engine is off and cooling, the loss of system pressure allows coolant to seep past the gasket and gravity-drain into a cylinder that sits below the coolant level. The coolant remains in the cylinder until the engine is started, at which point it is vaporized and expelled as white exhaust steam. Checking for coolant in the cylinders by removing the spark plugs is the logical first step.

3. A — GDI engines inject fuel directly into the combustion chamber rather than onto the intake valve, so the valve backs never receive the fuel-washing effect that keeps port-injected engine valves relatively clean. [A] Carbon from PCV gases, EGR gases, and oil vapor accumulates on the valve backs over time, disrupting airflow into the cylinder during cold start when fuel atomization is already poor. Walnut shell blasting or chemical cleaning physically removes the carbon deposits and addresses the root cause of the cold-start roughness.

4. C — All bore measurements are well within the manufacturer's specifications — 0.0008 inches of taper versus a 0.002-inch maximum, and 0.0005 inches of out-of-round versus a 0.001-inch maximum — with no visible bore damage. [C] The bores are in serviceable condition and do not require boring. A light hone to restore the crosshatch pattern for new ring seating is all that is needed, along with new standard-size piston rings matched to the existing bore diameters.

5. D — An engine that stalls only at hot idle with the A/C compressor engaged, with normal compression and oil pressure, points to an idle speed control problem rather than an engine mechanical issue. [A] The A/C compressor places a significant parasitic load on the engine at idle, and the idle air control valve or electronic throttle must compensate by increasing airflow to maintain RPM. If this compensation system is faulty — a dirty IAC valve, a sticking electronic throttle, or an incorrect idle speed calibration — the engine cannot sustain idle under the added load.

6. A — Both technicians are correct. [A] Technician A is right that engine mounts should be inspected during engine reinstallation because deteriorated rubber allows excessive engine movement. Technician B is right about the consequences — an engine that shifts on worn mounts can stretch, kink, or disconnect wiring harnesses, vacuum hoses, coolant hoses, and exhaust connections, creating driveability problems and potential safety hazards that are difficult to diagnose because they appear unrelated to the original repair.

7. B — Boost pressure reaching the target specification on the scan tool eliminates the turbocharger, wastegate, and exhaust energy as the problem — the turbo is making correct boost. [A] However, correct boost pressure does not guarantee correct charge air density. A clogged intercooler restricts airflow and fails to cool the compressed charge, resulting in hot, low-density air reaching the cylinders. Hot air has fewer oxygen molecules per volume, reducing power output even though the pressure gauge reads correctly.

8. B — Deck height — the distance from the crankshaft centerline to the block deck surface — determines where the piston crown sits relative to the top of the bore at TDC. [C] A deck height that is 0.005 inches less than specification means the deck surface has been lowered (from previous resurfacing), which moves the piston closer to TDC relative to the deck. Depending on the piston design, this may cause the piston to protrude above the deck, reducing head gasket crush and potentially contacting the cylinder head.

9. C — Air escaping simultaneously from the oil filler cap and the tailpipe on the same cylinder indicates two separate leak paths — worn piston rings (air past the rings into the crankcase, exiting at the oil filler) and a non-seating exhaust valve (air past the valve into the exhaust, exiting at the tailpipe). [A] A single component failure cannot produce leakage at both locations simultaneously. This cylinder has both ring wear and a valve sealing problem, which explains the high 22% combined leakage reading.

10. A — Both technicians are correct. [A] Ethylene glycol is classified as a toxic substance and must be handled, stored, and disposed of in compliance with local and federal hazardous material regulations — it cannot be poured down drains or onto the ground. Technician B is also correct that the sweet taste of ethylene glycol attracts animals, and even small amounts ingested can cause fatal kidney failure in pets and wildlife. Immediate cleanup of spills is both an environmental and an animal safety requirement.

11. D — Constant blue smoke at all operating conditions combined with uniformly low compression that improves significantly on a wet test across all cylinders confirms generalized ring and bore wear throughout the engine. [D] The wet test improvement proves the rings cannot seal without the supplemental oil film, and the uniform nature of the readings indicates the wear is systemic rather than isolated to one or two cylinders. Valve stem seal failure would produce smoke primarily at startup or deceleration, not at all times. This engine requires a complete overhaul.

12. C — The torque sequence for TTY bolts exists to apply clamping force evenly and progressively across the entire head surface. [B] By completing both 90-degree turns on one bolt before moving to the next, the technician concentrates maximum clamping force at that single point while adjacent areas have only the initial 30 ft-lbs. This uneven force distribution can warp the cylinder head, distort cylinder bores beneath the over-clamped bolt locations, and create uneven gasket compression that leads to leaks.

13. A — A gradual decline in oil pressure over 60,000 miles on an engine that otherwise passes all mechanical tests is the natural progression of bearing wear over the engine's service life. [D] As main and rod bearing clearances slowly increase from normal operational wear, oil escapes from each bearing slightly faster. The pump must fill larger cumulative clearance volumes at idle, and at low pump speed, it cannot maintain the same pressure it did when clearances were tighter. This is expected aging behavior, not a failure.

14. B — All six plugs being wet with raw fuel confirms that fuel is being delivered to every cylinder. [E] Since fuel is present but the engine will not fire, the missing element is ignition — the spark plugs are not firing and the fuel sits unburned in the cylinders. The absence of DTCs may indicate a hard failure in the ignition system power supply or primary trigger circuit that occurred without setting a code. A spark test confirming no spark would verify this diagnosis.

15. D — When replacing a worn timing chain, the complete timing set — chain, crankshaft sprocket, camshaft sprocket, tensioner, and chain guides — should all be replaced because worn sprockets accelerate wear on a new chain. [B] However, the crankshaft main bearings are not part of the timing system and are not affected by timing chain wear. Main bearings support the crankshaft journals and are unrelated to chain deflection or sprocket condition. They would only be replaced if independent inspection revealed bearing wear.

16. C — Under heavy load, the increased cylinder pressure at the moment of ignition requires a proportionally higher voltage to ionize the gap and fire the spark plug. [E] On a plug with a cracked insulator, this higher voltage finds an easier path through the crack in the porcelain than across the designed electrode gap. The spark short-circuits through the insulator rather than jumping the gap, and the cylinder misfires. At idle and light load, the lower required voltage is insufficient to arc through the crack, so the plug fires normally.

17. A — Neither technician is correct — both have the definitions reversed. [A] A supercharger is driven mechanically by a belt connected to the crankshaft, not by exhaust gases. A turbocharger is driven by exhaust gas energy spinning a turbine wheel, not by a belt. This is a fundamental distinction that the ASE exam tests, and the question format is designed to catch technicians who confuse the two forced induction types.

18. D — Code P0420 with a normally switching upstream O2 sensor and a flat downstream sensor indicates the catalytic converter is no longer efficiently converting exhaust pollutants. [E] A healthy converter produces a significant chemical change between the upstream and downstream sensors. When the catalyst material degrades with age, the converter passes exhaust through without adequate conversion, and the downstream sensor begins to mirror the upstream sensor's switching pattern. The PCM detects the reduced efficiency and sets P0420.

19. C — The gear-to-housing tip clearance of 0.007 inches exceeds the maximum specification of 0.005 inches, confirming the pump is worn beyond serviceable limits. [D] Excessive tip clearance allows oil to leak back from the high-pressure outlet side to the low-pressure inlet side within the pump, reducing pumping efficiency and output pressure. Oil pumps are precision assemblies that are replaced as complete units — they are not rebuilt with individual replacement components.

20. C — The initial stethoscope diagnosis localized the noise to the number 4 rod bearing area, but the cylinder-disable test did not change the noise. [A] Rod bearing knock should diminish when the affected cylinder's injector is disabled because removing combustion load eliminates the impact force. If the noise does not change, the sound source is more likely a main bearing — main bearing knocks are not affected by single-cylinder disable because they support forces from all cylinders simultaneously. Sound transmits through the block material and can mislead stethoscope placement.

21. A — Uniformly low compression across all cylinders (115–120 PSI versus 145–160 specification) that developed after a timing belt service is the signature of incorrect cam timing. [A] If the belt was installed one tooth off, all cylinders experience equally retarded valve timing, producing uniformly reduced compression, decreased power, and increased fuel consumption. The absence of DTCs on a one-tooth error is common because the cam position deviation may be small enough that the PCM does not flag it, but the mechanical effect on compression and efficiency is significant.

22. D — A deep vertical score running the full length of a single cylinder bore is most commonly caused by a broken piston ring end that caught on the bore wall and dragged through the full stroke length. [C] Ring breakage can result from detonation damage, incorrect installation, insufficient end gap (causing the ends to butt and fracture), or fatigue from high-mileage operation. The sharp broken edge acts like a

cutting tool against the bore surface, leaving a groove that may be deep enough to prevent new rings from sealing.

23. B — A temperature gauge that rhythmically cycles between normal and slightly above normal at a consistent interval suggests a trapped air pocket circulating through the cooling system. [D] As the air pocket passes the temperature sensor, the sensor reads a momentary temperature spike (air does not absorb heat as effectively as liquid coolant). When the pocket moves past and liquid coolant contacts the sensor again, the reading drops back to normal. Bleeding the cooling system to remove the trapped air resolves the cyclic temperature fluctuation.

24. C — Both technicians are correct. [B] Technician A correctly identifies the inter-valve bridge area between adjacent exhaust seats as the thinnest and most crack-prone region of the cylinder head casting. Technician B correctly explains the mechanism — exhaust ports operate at the highest temperatures in the head, and the thin bridge area has limited material to absorb and distribute this heat. Overheating amplifies the thermal stress on this already vulnerable area, making it the most common location for heat-related head cracks.

25. A — A ticking noise from the valvetrain area on a specific cylinder of an OHV engine that developed 2,000 miles into operation on a rebuild, with correct oil level and viscosity, points to a hydraulic lifter with a developing internal check valve leak. [B] The lifter's check valve may have been marginally functional during initial assembly but has since deteriorated, allowing oil to bleed from the high-pressure chamber and collapsing the lifter. The collapsed lifter creates clearance between the pushrod and rocker arm, producing the characteristic tick.

26. D — Fuel pressure that reads correctly at key-on but drops rapidly from 58 PSI to 20 PSI within five minutes after key-off indicates a component in the fuel system is allowing pressure to bleed back. [E] The two most common causes are a leaking fuel injector that drips fuel into a cylinder and a faulty fuel pump check valve that allows fuel to drain back to the tank. This pressure loss causes extended cranking on the next start because the pump must repressurize the entire rail before the injectors can deliver adequate fuel.

27. B — A single main bearing bore that is significantly more out-of-round than all others when the cap is torqued indicates a problem specific to that cap-to-block interface. [C] Fretting damage — the rough, pitted surface caused by micro-movement between the cap and block under cyclic loading — prevents the cap from seating squarely, distorting the bore into an oval when torqued. The block requires align boring or align honing at that bearing position to restore a true round bore before new bearings can be installed.

28. A — An HVAC system that blows warm air on one side and cool air on the other, with both heater hoses hot and the engine at normal temperature, is a blend door actuator or blend door positioning problem — not an engine cooling system issue. [D] The dual-zone HVAC system uses separate blend doors for driver and passenger sides, each controlled by an electric actuator. If one actuator fails or the door is stuck, one side delivers heated air normally while the other side delivers unheated or partially heated air. This is a cabin climate control problem, not a coolant flow problem.

29. D — While a small amount of rotational compliance is normal in the rubber bonding of a harmonic balancer, visible rotational movement of 5 degrees indicates the rubber has partially separated and the bond has deteriorated internally. [A] Even though the outer ring does not appear visually shifted, the weakened bond means the balancer can no longer accurately transmit crankshaft position to the timing mark on the outer ring. The balancer should be replaced to ensure accurate timing mark position and effective torsional vibration dampening.

30. B — Any bearing shell with physical damage — even a nick that appears to be outside the load-carrying surface — should be replaced with an undamaged shell from a new set. [C] A nick near the locating tang can interfere with proper bearing seating in the bore, potentially allowing the shell to shift slightly or creating a stress concentration point. Given that bearing shells are inexpensive relative to the cost of a bearing failure, the risk of installing a damaged shell is never justified.

31. B — Running an engine for two minutes with no oil destroys the hydrodynamic oil film that separates every bearing surface from its journal. [D] Without this film, the soft bearing material contacts the hardened journal surface directly, generating extreme heat and friction that scores, melts, and welds the bearing material. The main and rod bearings are the most critically affected because they support the highest loads. The loud knock and very low oil pressure after adding oil confirm the bearing surfaces are destroyed.

32. A — Both technicians are correct. [E] GDI fuel systems operate at extremely high pressures — 500 to 2,900 PSI — to inject fuel directly into the combustion chamber against the high compression pressures present during the injection event. Port fuel injection systems operate at much lower pressures — 35 to 65 PSI — because they inject fuel into the intake port where pressures are at or below atmospheric. The pressure difference between the two systems is a fundamental distinction tested on the ASE exam.

33. D — A broken screw extractor lodged inside a broken stud in an aluminum head is one of the most challenging fastener extraction scenarios. [B] Screw extractors are made of extremely hard, brittle tool steel that resists conventional drilling. A spark eroder (electrical discharge machine, or EDM) can vaporize the extractor and stud material without damaging the surrounding aluminum. Specialized

carbide-tipped broken extractor removal bits are also designed for this purpose. Heating aluminum to cherry red would risk melting or severely distorting the head.

34. C — A radiator cap that releases at 18 PSI instead of its rated 16 PSI is not functioning to specification — it is holding pressure 2 PSI above its design point before opening the relief valve. [D] While this may seem beneficial, the cap is a calibrated safety device designed to protect the rest of the cooling system. Over-pressurization stresses radiator tanks, hose connections, and gasket seals that were designed for a maximum of 16 PSI. The cap should be replaced with one that releases at its rated pressure.

35. B — The engine shows compression readings at the very bottom of the specification range (125–130 PSI versus 125–160), and idle vacuum is already below the 15 in. Hg minimum without the A/C engaged. [A] When the A/C compressor adds its parasitic load, the already-marginal engine cannot maintain stable combustion at the further-reduced vacuum and RPM. The combination of borderline compression and the additional load exceeds the engine's ability to sustain smooth idle. The rough idle worsening with A/C is a symptom of marginal engine mechanical condition, not an A/C system problem.

36. A — The oil pickup screen must be positioned at the correct distance from the bottom of the oil pan — typically 1/4 to 3/8 inch — to ensure it remains submerged in oil under all driving conditions. [D] If the screen is too close to the pan floor, it can become restricted by sludge or contact the pan. If it is too far from the floor, it may draw air during hard braking, cornering, or acceleration when oil sloshes away from the screen. This clearance measurement is the most critical installation dimension.

37. C — A temperature reading that is slightly higher than the customer's previous normal after a coolant flush and refill suggests the coolant mixture may be incorrect. [D] Pure antifreeze or a mixture with too much antifreeze relative to water actually transfers heat less efficiently than a proper 50/50 mixture. The reduced heat transfer capability causes the engine to run slightly warmer than normal. Verifying the coolant concentration with a refractometer and adjusting to the manufacturer's specified ratio resolves the elevated temperature.

38. D — The clearance is 3.5005 minus 3.4990, which equals 0.0015 inches — exactly within the 0.0010 to 0.0020-inch specification. [C] This clearance provides the optimal balance between allowing the aluminum piston to expand freely without seizing and maintaining tight enough fit to minimize piston slap and blowby. The components are ready for assembly with proper lubrication.

39. B — Repeat head gasket failures on the same engine — three failures in 18 months — despite proper head reconditioning, new gaskets, and new bolts each time strongly indicates the root cause of the original failure was never identified and corrected. [D] The most common root cause is the cooling system fault that caused the initial overheating — a failed fan, a restricted radiator, a weak radiator cap, or a clogged coolant passage. Each repair fixes the symptom (failed gasket) but the underlying overheating condition destroys the new gasket within months.

40. A — Both technicians are correct. [D] Technician A is right: a positive-displacement oil pump moves a fixed volume of oil per revolution regardless of downstream pressure — the pump does not "know" what the system pressure is. Technician B is also right: if bearing clearances double, oil flows through them at a much higher rate, and the pump must deliver proportionally more volume to maintain the same system pressure. This is why worn bearings cause low oil pressure — the pump's fixed output cannot keep up with the increased leakage.

41. C — Unlike compression rings that must have a specific end gap to allow for thermal expansion, the oil ring expander is designed to butt together or slightly overlap at its ends when installed in the bore. [C] The expander's function is to push the two thin oil ring rails outward against the bore wall — it does not need an end gap for thermal expansion because it operates under much lower thermal stress than the compression rings. A zero gap or slight overlap on the expander is within the manufacturer's design specification.

42. B — A vibration at a specific RPM that appeared after engine work and was not present before suggests a component in the rotating assembly or its attachments was disturbed during the repair. [A] The harmonic balancer is the most likely culprit because it is routinely removed during major engine work and must be reinstalled with the correct orientation, torque, and alignment. A damaged, incorrectly seated, or deteriorated balancer can produce a resonance vibration at a specific RPM where the natural frequency of the assembly is excited.

43. D — A timing chain rattle at idle that disappears above 1,500 RPM on a high-mileage engine with correct oil level and pressure indicates the chain tensioner cannot maintain adequate tension at the lower oil pressures and flow volumes present at idle. [B] Hydraulic tensioners rely on engine oil pressure to extend their plunger and take up chain slack. A tensioner with worn internal seals or a weak check valve bleeds oil from its high-pressure chamber at idle, allowing the chain to develop slack and rattle. At higher RPM, increased oil pressure overcomes the internal leakage and the tensioner extends, silencing the rattle.

44. A — Removing the interior light fuse dropped the draw from 65 mA to 30 mA, confirming that 35 mA of the parasitic draw is on the interior light circuit. [E] The correct next step is to inspect every

component on that circuit — door switches, courtesy light switches, trunk light, glove box light, vanity mirror lights, and any control modules that manage interior lighting. One of these components is remaining active or energized with the vehicle off. Replacing fuses, changing bulb types, or disconnecting the battery are workarounds that do not address the root cause.

45. C — A hairline crack between adjacent exhaust valve seats in an aluminum cylinder head is a structural defect that cannot be reliably repaired. [B] Weld repairs on aluminum heads in this high-stress, high-temperature area are prone to re-cracking because the thin bridge material between valve seats experiences extreme thermal cycling. Pinning does not restore the metallurgical integrity of the casting. The head should be replaced with a new or known-good remanufactured unit to ensure long-term reliability.

46. B — Piston cooling jets are specifically aimed to direct a stream of pressurized oil onto the underside of the piston crown — the hottest area of the piston — to remove heat and prevent detonation, ring sticking, and piston scuffing. [C] A misaimed jet on cylinder 2 means that piston runs hotter than the others, creating an imbalance in thermal loading across the engine. The jet must be straightened to its correct aim or replaced if it cannot be properly aligned. Removing all jets or ignoring the misalignment invites thermal damage on the affected cylinder.

47. D — Higher compression than pre-rebuild readings combined with severe oil consumption on a freshly rebuilt engine with new oversize pistons and rings points to a ring sealing problem — not a bore or piston defect. [A] The most likely cause is that the piston ring end gaps were too large, allowing both compression gas and oil to pass through the gaps. The higher compression readings reflect the new pistons and tighter bore dimensions, but the excessive end gaps prevent the rings from sealing effectively. Alternatively, the rings may not have been installed with proper orientation (top-side markings).

48. A — Both technicians are correct. [A] Technician A is right: expansion-type replacement plugs are hammered into the freeze plug bore, where they expand against the bore wall and create a seal — this is a standard and effective repair method. Technician B is also right: brass or stainless steel replacement plugs resist the corrosion that causes steel freeze plugs to fail in the first place, providing a more durable long-term repair in engines that operate in corrosive environments.

49. C — An intermittent single backfire through the intake at cold start that occurs very infrequently and leaves no stored codes is consistent with a VVT cam phaser that has partially drained oil and momentarily rests in an incorrect position. [A] If the intake camshaft is slightly advanced or retarded from its correct start position due to the drained phaser, the intake valve may be partially open during the compression stroke on one cylinder. The compressed charge pushes back through the open intake

valve into the manifold, producing a backfire. Once oil pressure refills the phaser (within the first second of cranking), the timing corrects and the engine runs normally.

50. B — The customer's oil consumption rate of one quart per 3,000 miles falls well within the manufacturer's published acceptable range of one quart per 2,000 miles. [D] All diagnostic tests — compression, leak-down, smoke, and PCV — are normal. The technician should inform the customer that the engine is functioning within its design parameters and that the observed oil consumption does not indicate a defect or need for repair. Recommending unnecessary engine work for consumption that the manufacturer considers normal is both technically incorrect and ethically inappropriate.