Apprentice Grading System					
1. **Student is first introduced**					
2. **Student unable to complete task.**					
3. **Student can complete the task under direct supervision.**					
4. **Student can complete the task without direct supervision.**					
5. **Student is proficient with task and theory.**					
ENGINE REPAIR					
	RO #	Grade	RO #	Grade	RO #
A. General Engine Diagnosis; Removal and Reinstallation (R & R)					
1. Identify and interpret engine concern; determine necessary action.					
2. Research applicable vehicle and service information, such as internal engine operation, vehicle service history, service precautions, and technical service bulletins.					
3. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).					
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.					
5. Diagnose engine noises and vibrations; determine necessary action.					
6. Diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine necessary action.					
7. Perform engine vacuum tests; determine necessary action.					
8. Perform cylinder power balance tests; determine necessary action.					
9. Perform cylinder compression tests; determine necessary action.					
10. Perform cylinder leakage tests; determine necessary action.					
11. Remove and reinstall engine in a late model front-wheel drive vehicle (**OBDI** or newer); reconnect all attaching components and restore the vehicle to running condition.					
12. Remove and reinstall engine in a late model rear-wheel drive vehicle (**OBDI** or newer); reconnect all attaching components and restore the vehicle to running condition.					
B. Cylinder Head and Valve Train Diagnosis and Repair					
1. Remove cylinder head(s); visually inspect cylinder head(s) for cracks; check gasket surface areas for warpage and leakage; check passage condition.					
2. Install cylinder heads and gaskets; tighten according to manufacturer's specifications and procedures.					
3. Inspect valve springs for squareness and free height comparison; determine necessary action.					
4. Replace valve stem seals on an assembled engine; inspect valve spring retainers, locks, and valve grooves; determine necessary action.					
5. Inspect valve guides for wear; check valve stem-to-guide clearance; determine necessary action.					
6. Inspect valves and valve seats; determine necessary action.					
7. Check valve face-to-seat contact and valve seat concentricity (runout); determine necessary action.					
8. Check valve spring assembled height and valve stem height; determine necessary action.					
9. Inspect pushrods, rocker arms, rocker arm pivots and shafts for wear, bending, cracks, looseness, and blocked oil passages (orifices); determine necessary action.					
10. Inspect hydraulic or mechanical lifters; determine necessary action.					
11. Adjust valves (mechanical or hydraulic lifters).					
	RO #	Grade	RO #	Grade	RO #

12. Inspect camshaft drives (including gear wear and backlash, sprocket and chain wear); determine necessary action.					
13. Inspect and replace timing belts (chains), overhead camdrive sprockets, and tensioners; check belt/chain tension; adjust as necessary.					
14. Inspect camshaft for runout, journal wear and lobe wear.					
15. Inspect camshaft bearing surface for wear, damage, out-of-round, and alignment; determine necessary action.					
16. Establish camshaft(s) timing and cam sensor indexing according to manufacturer's specifications and procedures.					
C. Engine Block Assembly Diagnosis and Repair					
1. Disassemble engine block; clean and prepare components for inspection and reassembly.					
2. Inspect engine block for visible cracks, passage condition, core and gallery plug condition, and surface warpage; determine necessary action.					
3. Inspect internal and external threads; restore as needed (includes installing thread inserts).					
4. Inspect and measure cylinder walls for damage, wear, and ridges; determine necessary action.					
5. Deglaze and clean cylinder walls.					
6. Inspect and measure camshaft bearings for wear, damage, out-of-round, and alignment; determine necessary action.					
7. Inspect crankshaft for end play, straightness, journal damage, keyway damage, thrust flange and sealing surface condition, and visual surface cracks; check oil passage condition; measure journal wear; check crankshaft sensor reluctor ring (where applicable); determine necessary action.					
8. Inspect and measure main and connecting rod bearings for damage, clearance, and end play; determine necessary action (includes the proper selection of bearings).					
9. Identify piston and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems; inspect rod alignment and bearing bore condition.					
10. Inspect and measure pistons; determine necessary action.					
11. Remove and replace piston pin.					
12. Inspect, measure, and install piston rings.					
13. Inspect auxiliary (balance, intermediate, idler, counterbalance or silencer) shaft(s); inspect shaft(s) and support bearings for damage and wear; determine necessary action; reinstall and time.					
14. Inspect or replace crankshaft vibration damper (harmonic balancer).					
15. Assemble the engine using gaskets, seals, and formed-in-place (tube-applied) sealants, thread sealers, etc. according to manufacturer's specifications.					
D. Lubrication and Cooling Systems Diagnosis and Repair					
1. Perform oil pressure tests; determine necessary action.					
2. Inspect oil pump gears or rotors, housing, pressure relief devices, and pump drive; perform necessary action.					
3. Perform cooling system, cap, and recovery system tests (pressure, combustion leakage, and temperature); determine necessary action.					
4. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment.					
5. Inspect and replace engine cooling and heater system hoses.					
6. Inspect, test, and replace thermostat and housing.					
7. Test coolant; drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required.					
	RO #	Grade	RO #	Grade	RO #
8. Inspect, test, remove, and replace water pump.					

9. Remove and replace radiator.					
10. Inspect, and test fans(s) (electrical or mechanical), fan clutch, fan shroud, and air dams.					
11. Inspect auxiliary oil coolers; determine necessary action.					
12. Inspect, test, and replace oil temperature and pressure switches and sensors.					
13. Perform oil and filter change.					
II. AUTOMATIC TRANSMISSION AND TRANSAXLE					
A. General Transmission and Transaxle Diagnosis					
1. Identify and interpret transmission/transaxle concern; assure proper engine operation; determine necessary action.					
2. Research applicable vehicle and service information, such as transmission/transaxle system operation, vehicle service history, service precautions, and technical service bulletins.					
3. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).					
4. Diagnose fluid usage, level, and condition concerns; determine necessary action.					
5. Perform pressure tests; determine necessary action.					
6. Perform stall test; determine necessary action.					
7. Perform lock-up converter system tests; determine necessary action.					
8. Diagnose electronic, mechanical, hydraulic, vacuum control system concerns; determine necessary action.					
9. Diagnose noise and vibration concerns; determine necessary action.					
10. Diagnose transmission/transaxle gear reduction/multiplication concerns using driving, driven, and held member (power flow) principles.					
B. Transmission and Transaxle Maintenance and Adjustment					
1. Inspect, adjust or replace throttle valve (TV) linkages or cables; manual shift linkages or cables; transmission range sensor; check gear select indicator (as applicable).					
2. Service transmission; perform visual inspection; replace fluids and filters.					
C. In-Vehicle Transmission and Transaxle Repair					
1. Inspect, adjust or replace (as applicable) vacuum modulator; inspect and repair or replace lines and hoses.					
2. Inspect, repair, and replace governor assembly.					
3. Inspect and replace external seals and gaskets.					
4. Inspect extension housing, bushings and seals; perform necessary action.					
5. Inspect, leak test, flush, and replace cooler, lines, and fittings.					
6. Inspect and replace speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers.					
7. Diagnose electronic transmission control systems using a scan tool; determine necessary action.					
8. Inspect, replace, and align powertrain mounts.					
D. Off-Vehicle Transmission and Transaxle Repair					
	RO #	Grade	RO #	Grade	RO #

1. Removal, Disassembly, and Reinstallation					
1. Remove and reinstall transmission and torque converter (rear-wheel drive and front wheel drive)					
2. Remove and reinstall transaxle and torque converter assembly.					
3. Disassemble, clean, and inspect transmission/transaxle.					
4. Inspect, measure, clean, and replace valve body (includes surfaces and bores, springs, valves, sleeves, retainers, brackets, check-balls, screens, spacers, and gaskets).					
5. Inspect servo bore, piston, seals, pin, spring, and retainers; determine necessary action.					
6. Inspect accumulator bore, piston, seals, spring, and retainer; determine necessary action.					
7. Assemble transmission/transaxle.					
2. Oil Pump and Converter					
1. Inspect converter flex plate, attaching parts, pilot, pump drive, and seal areas.					
2. Measure torque converter endplay and check for interference; check stator clutch.					
3. Inspect, measure, and reseal oil pump assembly and components.					
3. Gear Train, Shafts, Bushings and Case					
1. Measure endplay or preload; determine necessary action.					
2. Inspect, measure, and replace thrust washers and bearings.					
3. Inspect oil delivery seal rings, ring grooves, and sealing surface areas.					
4. Inspect bushings; determine necessary action.					
5. Inspect and measure planetary gear assembly (includes sun, ring gear, thrust washers, planetary gears, and carrier assembly); determine necessary action.					
6. Inspect case bores, passages, bushings, vents, and mating surfaces; determine necessary action.					
7. Inspect transaxle drive, link chains, sprockets, gears, bearings, and bushings; perform necessary action.					
8. Inspect, measure, repair, adjust or replace transaxle final drive components.					
9. Inspect and reinstall parking pawl, shaft, spring, and retainer; determine necessary action.					
4. Friction and Reaction Units					
1. Inspect clutch drum, piston, check-balls, springs, retainers, seals, and friction and pressure plates; determine necessary action.					
2. Measure clutch pack clearance; determine necessary action.					
3. Air test operation of clutch and servo assemblies.					
4. Inspect roller and sprag clutch, races, rollers, sprags, springs, cages, and retainers; replace as needed.					
5. Inspect bands and drums; determine necessary action.					
III. MANUAL DRIVE TRAIN AND AXLES					
A. General Drive Train Diagnosis					
1. Identify and interpret drive train concern; determine necessary action.					
2. Research applicable vehicle and service information, such as drive train system operation, vehicle service history, service precautions, and technical service bulletins.					
	RO #	Grade	RO #	Grade	RO #
3. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals).					
4. Diagnose fluid usage, level, and condition concerns; determine necessary action.					
5. Drain and fill manual transmission/transaxle and final drive unit.					

B. Clutch Diagnosis and Repair					
1. Diagnose clutch noise, binding, slippage, pulsation, and chatter; determine necessary action.					
2. Inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs; perform necessary action.					
3. Inspect hydraulic clutch slave and master cylinders, lines, and hoses; determine necessary action.					
4. Inspect release (throw-out) bearing, lever, and pivot; determine necessary action.					
5. Inspect and replace clutch pressure plate assembly and clutch disc.					
6. Bleed clutch hydraulic system.					
7. Inspect, remove or replace pilot bearing or bushing (as applicable).					
8. Inspect flywheel and ring gear for wear and cracks, determine necessary action.					
9. Inspect engine block, clutch (bell) housing, transmission/transaxle case mating surfaces, and alignment dowels; determine necessary action.					
10. Measure flywheel runout and crankshaft endplay; determine necessary action.					
C. Transmission/Transaxle Diagnosis and Repair					
1. Remove and reinstall transmission/transaxle.					
2. Disassemble, clean, and reassemble transmission/transaxle components.					
3. Inspect transmission/transaxle case, extension housing, case mating surfaces, bores, bushings, and vents; perform necessary action.					
4. Diagnose noise, hard shifting, jumping out of gear, and fluid leakage concerns; determine necessary action.					
5. Inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots, and levers.					
6. Inspect and reinstall powertrain mounts.					
7. Inspect and replace gaskets, seals, and sealants; inspect sealing surfaces.					
8. Remove and replace transaxle final drive.					
9. Inspect, adjust, and reinstall shift cover, forks, levers, grommets, shafts, sleeves, detent mechanism, interlocks, and springs.					
10. Measure endplay or preload (shim or spacer selection procedure) on transmission/transaxle shafts; perform necessary action.					
11. Inspect and reinstall synchronizer hub, sleeve, keys (inserts), springs, and blocking rings.					
12. Inspect and reinstall speedometer drive gear, driven gear, vehicle speed sensor (VSS), and retainers.					
13. Diagnose transaxle final drive assembly noise and vibration concerns; determine necessary action.					
14. Remove, inspect, measure, adjust, and reinstall transaxle final drive pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case assembly.					
15. Inspect lubrication devices (oil pump or slingers); perform necessary action.					
16. Inspect, test, and replace transmission/transaxle sensors and switches.					
D. Drive Shaft and Half Shaft, Universal and Constant-Velocity (CV) Joint Diagnosis and Repair					
	RO #	Grade	RO #	Grade	RO #
1. Diagnose constant-velocity (CV) joint noise and vibration concerns; determine necessary action.					
2. Diagnose universal joint noise and vibration concerns; perform necessary action.					

3. Replace front wheel drive (FWD) front wheel bearing.					
4. Inspect, service, and replace shafts, yokes, boots, and CV joints.					
5. Inspect, service, and replace shaft center support bearings.					
6. Check shaft balance; measure shaft runout; measure and adjust driveline angles.					
E. Drive Axle Diagnosis and Repair					
1. Ring and Pinion Gears and Differential Case Assembly					
1. Diagnose noise and vibration concerns; determine necessary action.					
2. Diagnose fluid leakage concerns; determine necessary action.					
3. Inspect and replace companion flange and pinion seal; measure companion flange runout.					
4. Inspect ring gear and measure runout; determine necessary action.					
5. Remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings.					
6. Measure and adjust drive pinion depth.					
7. Measure and adjust drive pinion bearing preload.					
8. Measure and adjust side bearing preload and ring and pinion gear total backlash and backlash variation on a differential carrier assembly (threaded cup or shim types).					
9. Check ring and pinion tooth contact patterns; perform necessary action.					
10. Disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shaft, side gears, side bearings, thrust washers, and case.					
11. Reassemble and reinstall differential case assembly; measure runout; determine necessary action.					
2. Limited Slip Differential					
1. Diagnose noise, slippage, and chatter concerns; determine necessary action.					
2. Inspect and flush differential housing; refill with correct lubricant.					
3. Inspect and reinstall clutch (cone or plate) components.					
4. Measure rotating torque; determine necessary action.					
3. Drive Axle Shaft					
1. Diagnose drive axle shafts, bearings, and seals for noise, vibration, and fluid leakage concerns; determine necessary action.					
2. Inspect and replace drive axle shaft wheel studs.					
3. Remove and replace drive axle shafts.					
4. Inspect and replace drive axle shaft seals, bearings, and retainers.					
5. Measure drive axle flange runout and shaft endplay; determine necessary action.					
F. Four-wheel Drive/All-wheel Drive Component Diagnosis and Repair					
1. Diagnose noise, vibration, and unusual steering concerns; determine necessary action.					
2. Inspect, adjust, and repair shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets.					
	RO #	Grade	RO #	Grade	RO #
3. Remove and reinstall transfer case.					
4. Disassemble, service, and reassemble transfer case and components.					
5. Inspect front-wheel bearings and locking hubs; perform necessary action.					
6. Check drive assembly seals and vents; check lube level.					
7. Diagnose test, adjust, and replace electrical/electronic components of four-wheel drive systems.					

IV. SUSPENSION AND STEERING					
A. General Suspension and Steering Systems Diagnosis					
1. Identify and interpret suspension and steering concern; determine necessary action.					
2. Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins.					
3. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals).					
B. Steering Systems Diagnosis and Repair					
1. Disable and enable supplemental restraint system (SRS).					
2. Remove and replace steering wheel; center/time supplemental restraint system (SRS) coil (clock spring).					
3. Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action.					
4. Diagnose power steering gear (non-rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action.					
5. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, and fluid leakage concerns; determine necessary action.					
6. Inspect steering shaft universal-joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action.					
7. Adjust manual or power non-rack and pinion worm bearing preload and sector lash.					
8. Remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets.					
9. Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots.					
10. Inspect power steering fluid levels and condition.					
11. Flush, fill, and bleed power steering system.					
12. Diagnose power steering fluid leakage; determine necessary action.					
13. Remove, inspect, replace, and adjust power steering pump belt.					
14. Remove and reinstall power steering pump.					
15. Remove and reinstall power steering pump pulley; check pulley and belt alignment.					
16. Inspect and replace power steering hoses and fittings.					
17. Inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper.					
18. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps.					
19. Test and diagnose components of electronically controlled steering systems using a scan tool; determine necessary action.					
C. Suspension Systems Diagnosis and Repair					
	RO #	Grade	RO #	Grade	RO #
1. Front Suspension					
1. Diagnose short and long arm suspension system noises, body sway, and uneven riding height concerns; determine necessary action.					
2. Diagnose strut suspension system noises, body sway, and uneven riding height concerns; determine necessary action.					

3. Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers.					
4. Remove, inspect and install strut rods (compression/tension) and bushings.					
5. Remove, inspect, and install upper and/or lower ball joints.					
6. Remove, inspect, and install steering knuckle assemblies.					
7. Remove, inspect, and install short and long arm suspension system coil springs and spring insulators.					
8. Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts.					
9. Remove, inspect, and install stabilizer bar bushings, brackets, and links.					
10. Remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount.					
11. Lubricate suspension and steering systems.					
2. Rear Suspension					
1. Remove, inspect, and install coil springs and spring insulators.					
2. Remove, inspect, and install transverse links, control arms, bushings, and mounts.					
3. Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts.					
4. Remove, inspect, and install strut cartridge or assembly, strut coil spring, and insulators (silencers).					
3. Miscellaneous Service					
1. Inspect, remove, and replace shock absorbers.					
2. Remove, inspect, and service or replace front and rear wheel bearings.					
3. Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action.					
E. Wheel and Tire Diagnosis and Repair					
1. Diagnose tire wear patterns; determine necessary action.					
2. Inspect tires; check and adjust air pressure.					
3. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action.					
4. Rotate tires according to manufacturer’s recommendations.					
5. Measure wheel, tire, axle, and hub runout; determine necessary action.					
6. Diagnose tire pull (lead) problem; determine necessary action.					
7. Balance wheel and tire assembly (static and dynamic).					
8. Dismount, inspect, repair, and remount tire on wheel.					
9. Reinstall wheel; torque lug nuts.					
10. Inspect and repair tire.					
V. BRAKES					
A. General Brake Systems Diagnosis					
	RO #	Grade	RO #	Grade	RO #
1. Identify and interpret brake system concern; determine necessary action.					
2. Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins.					
3. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals).					
B. Hydraulic System Diagnosis and Repair					

1. Diagnose pressure concerns in the brake system using hydraulic principles (Paschal's Law).					
2. Measure brake pedal height; determine necessary action.					
3. Check master cylinder for internal and external leaks and proper operation; determine necessary action.					
4. Remove, bench bleed, and reinstall master cylinder.					
5. Diagnose poor stopping, pulling or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action.					
6. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action.					
7. Fabricate and/or install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed.					
8. Select, handle, store, and fill brake fluids to proper level.					
9. Inspect, test, and/or replace metering (hold-off), proportioning (balance), pressure differential, and combination valves.					
10. Inspect, test, and adjust height (load) sensing proportioning valve.					
11. Inspect, test, and/or replace components of brake warning light system.					
12. Bleed (manual, pressure, vacuum or surge) brake system.					
13. Flush hydraulic system.					
C. Drum Brake Diagnosis and Repair					
1. Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.					
2. Remove, clean (using proper safety procedures), inspect, and measure brake drums; determine necessary action.					
3. Refinish brake drum.					
4. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble.					
5. Remove, inspect, and install wheel cylinders.					
6. Pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings.					
7. Install wheel, torque lug nuts, and make final checks and adjustments.					
D. Disc Brake Diagnosis and Repair					
1. Diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action.					
2. Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing; determine necessary action.					
3. Clean and inspect caliper mounting and slides for wear and damage; determine necessary action.					
4. Remove, clean, and inspect pads and retaining hardware; determine necessary action.					
	RO #	Grade	RO #	Grade	RO #
5. Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts.					
6. Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks.					
7. Clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer's recommendations in determining need to machine or replace.					
8. Remove and reinstall rotor.					
9. Refinish rotor according to manufacturer's recommendations.					

10. Adjust calipers equipped with an integrated parking brake system.					
11. Install wheel, torque lug nuts, and make final checks and adjustments.					
E. Power Assist Units Diagnosis and Repair					
1. Test pedal free travel with and without engine running; check power assist operation.					
2. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster.					
3. Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action.					
4. Inspect and test hydro-boost system and accumulator for leaks and proper operation; determine necessary action.					
F. Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair					
1. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action.					
2. Remove, clean, inspect, repack, and install wheel bearings and replace seals; install hub and adjust wheel bearings.					
3. Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, or replace as needed.					
4. Check parking brake operation; determine necessary action.					
5. Check operation of parking brake indicator light system.					
6. Check operation of brake stop light system; determine necessary action.					
7. Replace wheel bearing and race.					
8. Inspect and replace wheel studs.					
9. Remove and reinstall sealed wheel bearing assembly.					
G. Antilock Brake and Traction Control Systems					
1. Identify and inspect antilock brake system (ABS) components; determine necessary action.					
2. Diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise concerns caused by the antilock brake system (ABS); determine necessary action.					
3. Diagnose antilock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine necessary action.					
4. Depressurize high-pressure components of the antilock brake system (ABS).					
5. Bleed the antilock brake system's (ABS) front and rear hydraulic circuits.					
6. Remove and install antilock brake system (ABS) electrical/electronic and hydraulic components.					
	RO #	Grade	RO #	Grade	RO #
7. Test, diagnose and service ABS speed sensors, toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data).					
8. Diagnose antilock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.).					
9. Identify traction control system components.					

VI. ELECTRICAL/ELECTRONIC SYSTEMS					
A. General Electrical System Diagnosis					
1. Identify and interpret electrical/electronic system concern; determine necessary action.					
2. Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.					
3. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).					
4. Diagnose electrical/electronic integrity for series, parallel and series-parallel circuits using principles of electricity (Ohm's Law).					
5. Use wiring diagrams during diagnosis of electrical circuit problems.					
6. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems.					
7. Check electrical circuits with a test light; determine necessary action.					
8. Measure source voltage and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action.					
9. Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action.					
10. Check continuity and measure resistance in electrical/electronic circuits and components using an ohmmeter; determine necessary action.					
11. Check electrical circuits using fused jumper wires; determine necessary action.					
12. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action.					
13. Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action.					
14. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action.					
15. Inspect and test switches, connectors, relays, solid state devices, and wires of electrical/electronic circuits; perform necessary action.					
16. Repair wiring harnesses and connectors.					
17. Perform solder repair of electrical wiring.					
B. Battery Diagnosis and Service					
1. Perform battery state-of-charge test; determine necessary action.					
2. Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action.					
3. Maintain or restore electronic memory functions.					
4. Inspect, clean, fill, and replace battery.					
5. Perform slow/fast battery charge.					
6. Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed.					
	RO #	Grade	RO #	Grade	RO #
7. Start a vehicle using jumper cables and a battery or auxiliary power supply.					
C. Starting System Diagnosis and Repair					
1. Perform starter current draw tests; determine necessary action.					
2. Perform starter circuit voltage drop tests; determine necessary action.					

3. Inspect and test starter relays and solenoids; determine necessary action.					
4. Remove and install starter in a vehicle.					
5. Inspect and test switches, connectors, and wires of starter control circuits; perform necessary action.					
6. Differentiate between electrical and engine mechanical problems that cause a slow-crank or no-crank condition.					
D. Charging System Diagnosis and Repair					
1. Perform charging system output test; determine necessary action.					
2. Diagnose charging system for the cause of undercharge, no-charge, and overcharge conditions.					
3. Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.					
4. Remove, inspect, and install generator (alternator).					
5. Perform charging circuit voltage drop tests; determine necessary action.					
E. Lighting Systems Diagnosis and Repair					
1. Diagnose the cause of brighter than normal, intermittent, dim, or no light operation; determine necessary action.					
2. Inspect, replace, and aim headlights and bulbs.					
3. Inspect and diagnose incorrect turn signal or hazard light operation; perform necessary action					
F. Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair					
1. Inspect and test gauges and gauge sending units for cause of intermittent, high, low, or no gauge readings; determine necessary action.					
2. Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action.					
3. Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action.					
4. Inspect and test sensors, connectors, and wires of electronic instrument circuits; determine necessary action.					
G. Horn and Wiper/Washer Diagnosis and Repair					
1. Diagnose incorrect horn operation; perform necessary action.					
2. Diagnose incorrect wiper operation; diagnose wiper speed control and park problems; perform necessary action.					
3. Diagnose incorrect washer operation; perform necessary action.					
	RO #	Grade	RO #	Grade	RO #
H. Accessories Diagnosis and Repair					
1. Diagnose incorrect operation of motor-driven accessory circuits; determine necessary action.					
2. Diagnose incorrect heated glass operation; determine necessary action.					
3. Diagnose incorrect electric lock operation; determine necessary action.					
4. Diagnose incorrect operation of cruise control systems; determine necessary action.					

5. Diagnose supplemental restraint system (SRS) concerns; determine necessary action. (Note: Follow manufacturer's safety procedures to prevent accidental deployment.)					
6. Disarm and enable the airbag system for vehicle service.					
7. Diagnose radio static and weak, intermittent, or no radio reception; determine necessary action.					
8. Remove and reinstall door panel.					
9. Diagnose body electronic system circuits using a scan tool; determine necessary action.					
10. Check for module communication errors using a scan tool.					
11. Diagnose the cause of false, intermittent, or no operation of anti-theft system.					
VII. HEATING AND AIR CONDITIONING					
A. A/C System Diagnosis and Repair					
1. Identify and interpret heating and air conditioning concern; determine necessary action.					
2. Research applicable vehicle and service information, such as heating and air conditioning system operation, vehicle service history, service precautions, and technical service bulletins.					
3. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals).					
4. Performance test A/C system; diagnose A/C system malfunctions using principles of refrigeration.					
5. Diagnose abnormal operating noises in the A/C system; determine necessary action.					
6. Identify refrigerant type; conduct a performance test of the A/C system; determine necessary action.					
7. Leak test A/C system; determine necessary action.					
8. Inspect the condition of discharged oil; determine necessary action.					
9. Determine recommended oil for system application.					
B. Refrigeration System Component Diagnosis and Repair					
1. Compressor and Clutch					
1. Diagnose A/C system conditions that cause the protection devices (pressure, thermal, and PCM) to interrupt system operation; determine necessary action.					
2. Inspect A/C compressor drive belts; determine necessary action.					
3. Inspect, test, and/or replace A/C compressor clutch components and/or assembly.					
4. Remove and reinstall A/C compressor and mountings; measure oil quantity; determine necessary action.					
	RO #	Grade	RO #	Grade	RO #
2. Evaporator, Condenser, and Related Components					
1. Determine need for an additional A/C system filter; perform necessary action.					
2. Remove and inspect A/C system mufflers, hoses, lines, fittings, O-rings, seals, and service valves; perform necessary action.					
3. Inspect A/C condenser for airflow restrictions; perform necessary action.					
4. Remove and reinstall receiver/drier or accumulator/drier; measure oil quantity; determine necessary action.					
5. Remove and install expansion valve or orifice (expansion) tube.					
6. Inspect evaporator housing water drain; perform necessary action.					

7. Remove and reinstall evaporator; measure oil quantity; determine necessary action.					
8. Remove and reinstall condenser; measure oil quantity; determine necessary action.					
C. Heating, Ventilation, and Engine Cooling Systems Diagnosis and Repair					
1. Diagnose temperature control problems in the heater/ventilation system; determine necessary action.					
2. Perform cooling system, cap, and recovery system tests (pressure, combustion leakage, and temperature); determine necessary action.					
3. Inspect engine cooling and heater system hoses and belts; perform necessary action.					
4. Inspect, test, and replace thermostat and housing.					
5. Determine coolant condition and coolant type for vehicle application; drain and recover coolant.					
6. Flush system; refill system with recommended coolant; bleed system.					
7. Inspect and test cooling fan, fan clutch, fan shroud, and air dams; perform necessary action.					
8. Inspect and test electric cooling fan, fan control system and circuits; determine necessary action.					
9. Inspect and test heater control valve(s); perform necessary action.					
10. Remove and reinstall heater core.					
D. Operating Systems and Related Controls Diagnosis and Repair					
1. Diagnose malfunctions in the electrical controls of heating, ventilation, and A/C (HVAC) systems; determine necessary action.					
2. Inspect and test A/C-heater blower, motors, resistors, switches, relays, wiring, and protection devices; perform necessary action.					
3. Test and diagnose A/C compressor clutch control systems; determine necessary action.					
4. Diagnose malfunctions in the vacuum and mechanical components and controls of the heating, ventilation, and A/C (HVAC) system; determine necessary action.					
5. Inspect and test A/C-heater control panel assembly; determine necessary action.					
6. Inspect and test A/C-heater control cables and linkages; perform necessary action.					
7. Inspect A/C-heater ducts, doors, hoses, cabin filters and outlets; perform necessary action.					
8. Check operation of automatic and semi-automatic heating, ventilation, and air-conditioning (HVAC) control systems; determine necessary action.					
E. Refrigerant Recovery, Recycling, and Handling					
1. Perform correct use and maintenance of refrigerant handling equipment.					
	RO #	Grade	RO #	Grade	RO #
2. Identify (by label application or use of a refrigerant identifier) and recover A/C system refrigerant.					
3. Recycle refrigerant.					
4. Label and store refrigerant.					
5. Test recycled refrigerant for non-condensable gases.					
6. Evacuate and charge A/C system.					
VIII. ENGINE PERFORMANCE					

A. General Engine Diagnosis					
1. Identify and interpret engine performance concern; determine necessary action.					
2. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins.					
3. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).					
4. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action.					
5. Diagnose abnormal engine noise or vibration concerns; determine necessary action.					
6. Diagnose abnormal exhaust color, odor, and sound; determine necessary action.					
7. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action.					
8. Perform cylinder power balance test; determine necessary action.					
9. Perform cylinder compression tests; determine necessary action.					
10. Perform cylinder leakage test; determine necessary action.					
11. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns with an oscilloscope and/or engine diagnostic equipment; determine necessary action.					
12. Prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test, and obtain exhaust readings; interpret readings, and determine necessary action.					
13. Verify engine operating temperature; determine necessary action.					
14. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action.					
15. Verify correct camshaft timing.					
B. Computerized Engine Controls Diagnosis and Repair					
1. Retrieve and record stored OBD I diagnostic trouble codes; clear codes.					
2. Retrieve and record stored OBD II diagnostic trouble codes; clear codes.					
3. Diagnose the causes of emissions or driveability concerns resulting from malfunctions in the computerized engine control system with stored diagnostic trouble codes.					
4. Diagnose emissions or driveability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action.					
5. Check for module communication errors using a scan tool.					
6. Inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action.					
7 Obtain and interpret scan tool data.					
8. Access and use service information to perform step-by-step diagnosis.					
	RO #	Grade	RO #	Grade	RO #
9. Diagnose driveability and emissions problems resulting from malfunctions of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM-installed accessories, or similar systems); determine necessary action.					
C. Ignition System Diagnosis and Repair					

1. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with electronic ignition (distributorless) systems; determine necessary action.					
2. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, poor mileage, and emissions concerns on vehicles with distributor ignition (DI) systems; determine necessary action.					
3. Inspect and test ignition primary circuit wiring and solid state components; perform necessary action.					
4. Inspect, test and service distributor.					
5. Inspect and test ignition system secondary circuit wiring and components; perform necessary action.					
6. Inspect and test ignition coil(s); perform necessary action.					
7. Check and adjust ignition system timing and timing advance/retard (where applicable).					
8. Inspect and test ignition system pick-up sensor or triggering devices; perform necessary action					
D. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair					
1. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with carburetor-type fuel systems; determine necessary action.					
2. Diagnose hot or cold no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems; determine necessary action.					
3. Check fuel for contaminants and quality; determine necessary action.					
4. Inspect and test mechanical and electrical fuel pumps and pump control systems for pressure, regulation and volume; perform necessary action.					
5. Replace fuel filters.					
6. Inspect and test cold enrichment system and components; perform necessary action.					
7. Inspect throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air.					
8. Inspect and test fuel injectors.					
9. Check idle speed and fuel mixture.					
10. Adjust idle speed and fuel mixture.					
11. Inspect the integrity of the exhaust manifold, exhaust pipes, muffler(s), catalytic converter(s), resonator(s), tail pipe(s), and heat shield(s); perform necessary action.					
12. Perform exhaust system back-pressure test; determine necessary action.					
13. Test the operation of turbocharger/supercharger systems; determine necessary action					
E. Emissions Control Systems Diagnosis and Repair					
	RO #	Grade	RO #	Grade	RO #
1. Positive Crankcase Ventilation					
1. Diagnose oil leaks, emissions, and driveability problems resulting from malfunctions in the positive crankcase ventilation (PCV) system; determine necessary action.					
2. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices, and hoses; perform necessary action.					
2. Exhaust Gas Recirculation					
1. Diagnose emissions and driveability problems caused by malfunctions in the exhaust gas recirculation (EGR) system; determine necessary action.					

2. Inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses; perform necessary action.					
3. Inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action.					
3. Exhaust Gas Treatment					
1. Diagnose emissions and driveability problems resulting from malfunctions in the secondary air injection and catalytic converter systems; determine necessary action.					
2. Inspect and test mechanical components of secondary air injection systems; perform necessary action.					
3. Inspect and test electrical/electronically-operated components and circuits of air injection systems; perform necessary action.					
4. Inspect and test catalytic converter performance.					
4. Intake Air Temperature Controls					
1. Diagnose emissions and driveability problems resulting from malfunctions in the intake air temperature control system; determine necessary action.					
2. Inspect and test components of intake air temperature control system; perform necessary action.					
5. Early Fuel Evaporation (Intake Manifold Temperature) Controls					
1. Diagnose emissions and driveability problems resulting from malfunctions in the early fuel evaporation control system; determine necessary action.					
2. Inspect and test components of early fuel evaporation control system; perform necessary action.					
6. Evaporative Emissions Controls					
1. Diagnose emissions and driveability problems resulting from malfunctions in the evaporative emissions control system; determine necessary action.					
2. Inspect and test components and hoses of evaporative emissions control system; perform necessary action.					
3. Interpret evaporative emission related diagnostic trouble codes (DTCs); determine necessary action.					
F. Engine Related Service					
1. Adjust valves on engines with mechanical or hydraulic lifters.					
2. Remove and replace timing belt; verify correct camshaft timing.					
3. Remove and replace thermostat.					
4. Inspect and test mechanical/electrical fans, fan clutch, fan shroud/ducting, air dams, and fan control devices; perform necessary action.					

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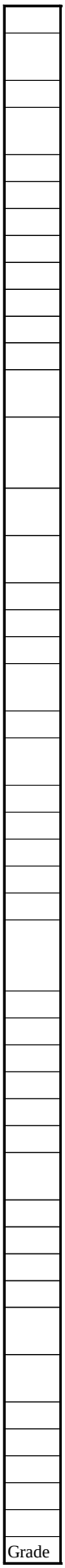
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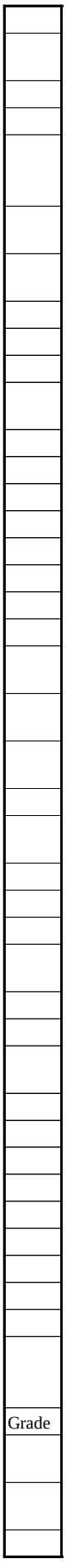
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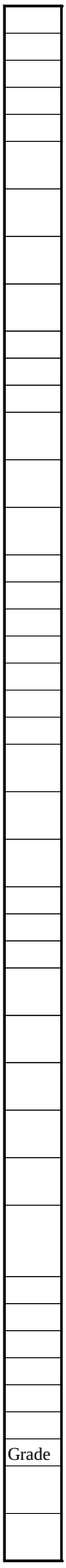
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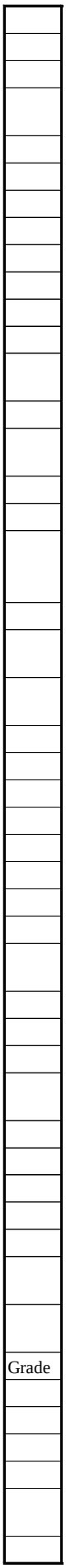
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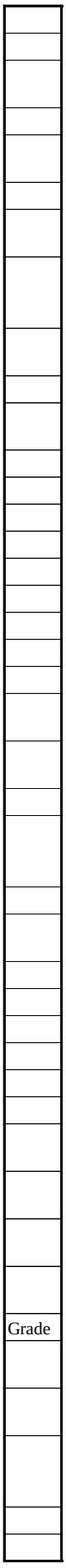
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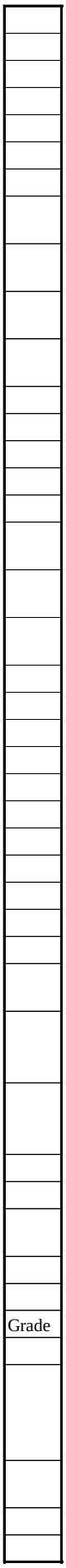
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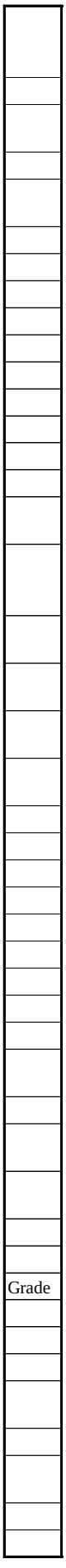
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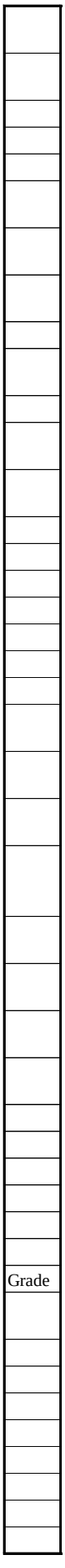
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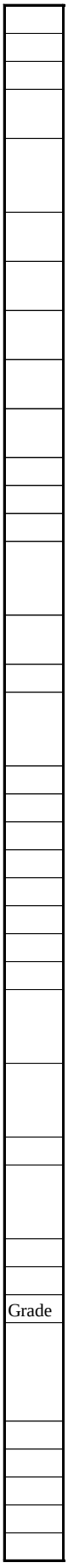
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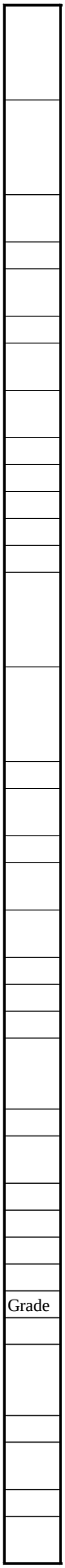
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