



AT

NEW CASTLE COUNTY VOCATIONAL TECHNICAL SCHOOL DISTRICT

Auto Technology

LOCATIONS

Delcastle Technical High School

Instructor: *Mr. Paul Davis*

Hodgson Vo-Tech High School

Instructor: *Mr. Gary Thornton*

St. Georges Technical
High School

Instructor: *Mr. James Hill*



Available Certifications

ASE

NOCTI

NATEF

10-Hour OSHA Training Card

Career Program Review:

Fall 2007

NEW CASTLE COUNTY VOCATIONAL TECHNICAL
SCHOOL DISTRICT

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Many auto technicians consider the quick and accurate diagnosis of "hard to find" trouble as one of their most challenging and satisfying responsibilities. To do this requires good reasoning ability, the willingness to do a job thoroughly and accurately, and a thorough knowledge of the automobile. Auto Technology is the program in which students can acquire and apply the knowledge, skills, and work ethic needed to become a successful auto technician. Most technicians perform a variety of repairs; however, some elect to specialize in one area such as front-end alignment, automotive electrical systems, transmissions, automotive machine shop, auto air conditioning, engine overhaul, or tune-up. Test driving, using sophisticated diagnostic equipment, making an accurate diagnosis, and pricing and communication with customers are all things a successful auto technician must be able to do. Jobs are plentiful throughout Delaware. Wages generally are above average, depending on the skill level of the technician. Many work situations will require service people to have their own tools and certification. Automobile fleet service dealers, independent repair facilities, and construction companies are just a few of the employers of skilled technicians. Auto Technology students are able to earn college credit through Tech Prep agreements with area colleges. Qualified students may test for certification through ASE/NATEF or NOCTI.

Employment opportunities available after high school graduation:

Automobile Technician, Engine Performance Specialist, Drivability Specialist, Automobile Electrical Specialist, Diesel Technician, Front Suspension Technician, Brake Technician, Automobile HVAC Technician, Transmission Technician, Automotive Parts Specialist

Employment opportunities requiring related work experience after high school graduation:

Automotive Service Manager, Automotive Service Manager/Service Advisor

Preferred Personal Attributes and Skills

Students interested in this career area should be able to:

- Understand and use schematic drawings, sketches, drawings and other specifications
- Detect differences in the shape, size, and texture of various items
- Pay strict attention to standards and guidelines
- Solve problems
- Use precision measuring tools
- Perform detailed work with accuracy
- Use diagnostic computers to check electronic computer components
- Rate information using standards that can be measured or checked
- Work within precise limits or standards of accuracy
- Use steady hand/eye coordination
- Read, write, and speak well
- Understand concepts of operations
- Work in a team
- Adapt to a flexible working environment

Average Earnings/Career Opportunities

Starting \$7.50/hr up to \$35/hr and above

- Automobile Technician - Class A, B, C, D
- Auto, Truck and Heavy Equipment Diesel Technician
- Engine Performance, Drivability, Electrical & Computer Specialist
- Front Suspension, Brakes, Heating, A/C Technician
- Engine and Transmission Technician
- Automotive Parts Specialist
- Automotive Service Manager
- Automotive Assistant Service Manager/Service Advisor

Auto Technology Learning Targets – Level I

These are the major tasks students will be expected to demonstrate in this career area:

Course Outline	CTE Knowledge & Skill Reference	Academic Standards
Safety Hand and Power Tools Shop Equipment	1.0 Students will apply safety procedures in the shop area when using all tools, equipment, chemicals and other materials according to standard (e.g., eye protection, fire safety, hand tool safety, machine and power tool safety and Right to Know).	Science Standard 1
	2.0 Students will perform specific jobs in the shop area related to various types of tools and equipment in a safe and effective manner.	
Engine Repair	1.0 Students will diagnose, remove and reinstall engines according to industry standards. 1.1 Students will interpret complaint and/or road test vehicles to determine needed repairs. (P1) 1.2 Students will inspect engine assemblies for fuel, oil, coolant, and other leaks to determine needed repairs. (P2) 1.3 Students will listen to engine noise and determine needed repairs. (P3) 1.4 Students will diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound according to standard. (P3) 1.5 Students will perform engine vacuum tests according to standard to determine needed repairs. (P1) 1.6 Students will perform cylinder power balance tests according to standard to determine needed repairs. (P1) 1.7 Students will perform cylinder compression tests according to standard to determine needed repairs. (P1) 1.8 Students will perform cylinder leakage tests according to standard to determine needed	Science Standard 1

	<p>repairs. (P1)</p> <p>1.9 Students will remove an engine (front wheel drive) and prepare for tear down according to standard. (P3)</p> <p>1.10 Students will reinstall an engine (front wheel drive) according to standard. (P3)</p> <p>1.11 Students will remove an engine (rear wheel drive) and prepare for break down according to standard. (P3)</p> <p>1.12 Students will reinstall an engine (rear wheel drive according to standard). (P3)</p>	
Engine Repair	<p>2.0 Students will perform cylinder head and valve train diagnosis and repair according to industry standards.</p> <p>2.1 Students will remove cylinder heads, visually inspect cylinder heads for cracks, gasket surface areas for warpage and leakage, and check passage condition according to standard. (P2)</p> <p>2.2 Students will install cylinder heads and gaskets according to standard. (P2)</p> <p>2.3 Students will inspect and test valve springs for squareness, pressure, and free height comparison according to standard, and replace as necessary. (P3)</p> <p>2.4 Students will inspect valve spring retainers, locks, and valve lock grooves according to standard. (P2)</p> <p>2.5 Students will replace valve stem seals according to standard. (P3)</p> <p>2.6 Students will inspect valves and resurface or replace according to standard. (P2)</p> <p>2.7 Students will inspect valve seats and resurface according to standard. (P3)</p> <p>2.8 Students will check valve face-to-seat contacts, service seats and valves according to standard. (P3)</p> <p>2.9 Students will check valve spring assembly height and valve stem height, and service valve and spring assemblies according to standard. (P2)</p> <p>2.10 Students will inspect pushrods, rocker arms, rocker arm pivots, and shafts for wear, bending, cracks, looseness, and</p>	Science Standard 1

	<p>blocked oil passages and will repair or replace parts, all according to standard. (P2)</p> <p>2.11 Students will inspect, test, and replace hydraulic or mechanical lifters according to standard. (P2)</p> <p>2.12 Students will adjust valves (mechanical and hydraulic lifters) according to standard. (P1)</p> <p>2.13 Students will inspect and replace camshaft drives, to include checking gear wear and backlash, sprocket and chain wear, overhead cam drive sprockets, drive belts, belt tension, and tensioners according to standard. (P2)</p> <p>2.14 Students will inspect and measure camshaft journals and lobes according to standard. (P3)</p> <p>2.15 Students will inspect and measure camshaft bearing surfaces for damage, out-of-round, and alignment according to standard to determine needed repairs. (P3)</p> <p>2.16 Inspect, replace and adjust timing belts and tensioners according to standard. (P1)</p> <p>2.17 Verify camshaft timing according to manufacturer's specifications and procedures. (P1)</p>	
Engine Repair	<p>3.0 Students will perform engine block diagnosis and repair according to industry standards.</p> <p>3.1 Students will inspect and replace pans, covers, gaskets, and seals according to standard. (P2)</p> <p>3.2 Students will visually inspect engine blocks for cracks, passage condition, core and gallery plug condition, and surface warpage according to standard to determine needed repairs. (P2)</p> <p>3.3 Students will inspect and repair damaged threads according to standard. (P1)</p> <p>3.4 Students will remove cylinder wall ridges according to standard. (P3)</p> <p>3.5 Students will inspect and measure cylinder walls for damage and wear according to standard to determine needed repairs. (P2)</p>	Science Standard 1

	<p>3.6 Students will hone and clean cylinder walls according to standard. (P1)</p> <p>3.7 Students will inspect camshaft bearings for wear according to standard to determine needed repairs. (P3)</p> <p>3.8 Students will inspect crankshafts for surface cracks and journal damage, check oil passage condition, and measure journal wear according to standard to determine needed repairs (P3)</p> <p>3.9 Students will inspect and measure main and connecting rod bearings for damage, clearance, and end play according to standard to determine needed repairs, including the proper selection of bearings. (P2)</p> <p>3.10 Students will inspect pistons and bearing wear patterns that indicate connecting rod alignment and main bearing bore problems and inspect rod alignment and bearing bore condition according to standard. (P3)</p> <p>3.11 Students will inspect, measure, service, and replace pistons according to standard. (P2)</p> <p>3.12 Students will inspect, measure, and install piston rings according to standard. (P2)</p> <p>3.13 Students will inspect, repair and replace crankshaft vibration dampers (harmonic balancer) according to standard. (P3)</p> <p>3.14 Students will inspect crankshaft flanges, flywheel/flex plates for burns, and repair same according to standard. (P3)</p> <p>3.15 Students will inspect flywheel/flex plates for cracks, wear (includes ring gear), and measure runout according to standard to determine needed repairs. (P3)</p> <p>3.16 Students will inspect, remove and replace crankshaft pilot bearing/bushings according to standard. (P2)</p> <p>3.17 Students will reassemble engine parts using correct gaskets and sealants according to standard. (P2)</p> <p>3.18 Students will prime engine lubrication systems according to standard. (P1)</p>	
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<p>Engine Repair</p>	<p>4.0 Students will diagnose lubrication systems and will repair according to industry standards.</p> <p>4.1 Students will perform oil pressure tests according to standard to determine needed repairs. (P1)</p> <p>4.2 Students will inspect, measure, repair, and replace oil pumps (includes gears, rotors, and housing), pressure relief devices, and pump drives according to standard. (P3)</p> <p>4.3 Students will inspect, test, and replace oil temperature/pressure switches and sensors according to standard. (P2)</p> <p>4.4 Students will perform oil and filter changes according to standard. (P1)</p> <p>4.5 Students will perform oil changes when special diesel/turbocharged engine procedures must be followed. (P1)</p> <p>4.6 Students will inspect auxiliary oil coolers and replace as necessary according to standard. (P3)</p>	<p>Science Standard 1</p>
<p>Engine Repair</p>	<p>5.0 Students will diagnose cooling systems and will repair according to industry standards.</p> <p>5.1 Students will perform cooling system tests (pressure, combustion leakage, and temperature) according to standard to determine needed repairs. (P1)</p> <p>5.2 Students will inspect, replace, and adjust drive belts and pulleys, including serpentine belts according to standard. (P1)</p> <p>5.3 Students will inspect and replace engine cooling and heater system hoses according to standard. (P2)</p> <p>5.4 Students will inspect, test, and replace thermostat bypasses and housings according to standard. (P2)</p> <p>5.5 Students will inspect coolant, drain, flush, refill, and recover and bleed cooling systems with recommended coolant according to standard. (P1)</p> <p>5.6 Students will operate cooling system flush/refill equipment according to standard. (P2)</p> <p>5.7 Students will inspect, test, and replace</p>	<p>Science Standard 1</p>

	<p>water pumps according to standard. (P2)</p> <p>5.8 Students will inspect, test, and replace radiators, pressure caps, and coolant recovery systems according to standard. (P2)</p> <p>5.9 Students will clean, inspect, test, and replace fan(s), electrical and mechanical, fan clutch, fan shroud, and cooling system related temperature sensors/switches according to standard. (P2)</p>	
Brakes	<p>1.0 Students will diagnose non-ABS brake systems and will repair according to industry standards.</p> <p>1.1 Students will diagnose poor stopping, pulling or dragging caused by problems in the disc brake caliper assembly according to standard to determine needed repairs. (P1)</p> <p>1.2 Students will diagnose poor stopping, noise, pulling, grabbing, dragging, or pedal pulsation caused by problems in the disc brake mechanical assembly according to standard to determine needed repairs. (P1)</p> <p>1.3 Students will remove caliper assembly from mountings and clean and inspect for leaks and damage to caliper housing according to standard. (P1)</p> <p>1.4 Students will clean and inspect caliper mountings and slides for wear and damage according to standard. (P1)</p> <p>1.5 Students will remove, clean and inspect pads and retaining hardware according to standard to determine needed repairs, adjustments and replacements. (P1)</p> <p>1.6 Students will remove, disassemble, and clean caliper assembly, inspect parts for wear, rust, scoring and damage according to standard and will replace all seals, boots, and any damaged or worn parts. (P1)</p> <p>1.7 Students will reassemble and reinstall calipers according to standard. (P1)</p> <p>1.8 Students will clean and inspect rotors and measure rotors with a dial indicator and a micrometer, all according to standard. (P1)</p> <p>1.9 Students will remove a rotor, mount it on a</p>	Science Standard 1

	<p>lathe, and machine according to specifications. (P1)</p> <p>1.10 Students will determine correct brake pad application according to standard. (P2)</p> <p>1.11 Students will adjust calipers with integrated parking brakes according to standard. (P2)</p> <p>1.12 Students will fill master cylinder with recommended fluid, seat pads, and inspect calipers for leaks, all according to standard. (P1)</p> <p>1.13 Students will reinstall wheel and torque lug nuts and make final checks and adjustments, all according to standard. (P1)</p> <p>1.14 Students will bleed (manual, pressure, vacuum or surge) brake systems and flush hydraulic systems according to standard. (P1)</p> <p>1.15 Students will diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation problems on drum brake systems according to standard to determine needed repairs. (P1)</p> <p>1.16 Students will remove, clean (using proper safety procedures), inspect, and measure brake drums and will service or replace, all according to standard. (P 1)</p> <p>1.17 Students will mount brake drums on lathes and will machine braking surfaces according to standard. (P2)</p> <p>1.18 Students will remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates and will lubricate and reassemble, all according to standard. (P2)</p> <p>1.19 Students will remove and install wheel cylinders according to standard. (P2)</p> <p>1.20 Student will pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings according to standard. (P2)</p> <p>1.21 Students will inspect, test, and replace components of brake warning light systems according to standard. (P2)</p>	
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	<p>1.22 Students will check master cylinders for internal and external leaks and for proper operation according to standard to determine needed repairs. (P2)</p> <p>1.23 Students will remove, bench bleed, and replace master cylinders according to standard. (P2)</p> <p>1.24 Students will diagnose poor stopping, pulling or dragging caused by problems in the hydraulic system according to standard to determine needed repairs. (P1)</p> <p>1.25 Students will inspect brake lines and fittings for leaks, dents, kinks, rust, cracks or wear and will tighten loose fittings and supports, all according to standard. (P2)</p> <p>1.26 Students will inspect flexible brake hoses for leaks, kinks, cracks, bulging or wear and will tighten loose fittings and supports, all according to standard. (P2)</p> <p>1.27 Students will fabricate and install brake lines (double flare and ISO types) and will replace hoses, fittings, and supports, all according to standard. (P2)</p> <p>1.28 Students will select, handle, store, and install brake fluids according to standard. (P1)</p> <p>1.29 Students will inspect, test, and replace metering (hold-off), proportioning (balance), pressure differential, and combination valves according to standard. (P3)</p> <p>1.30 Students will inspect, test, replace, and adjust height (load) sensing proportioning valves according to standard. (P3)</p> <p>1.31 Students will inspect, test, and replace components of brake warning light systems according to standard. (P3)</p> <p>1.32 Students will flush hydraulic systems according to standard. (P3)</p>	
Brakes	<p>2.0 Students will perform ABS, hydraulic, mechanical, and electrical component diagnosis and repair according to industry standards.</p> <p>2.1 Students will diagnose poor stopping,</p>	<p>Science Standard 1 Math 1</p>

	<p>wheel lock-up, abnormal pedal feel or pulsation, and noise problems caused by ABS according to standard to determine needed repairs. (P2)</p> <p>2.2 Students will observe ABS warning lights at startup and determine if further diagnosis is needed. (P2)</p> <p>2.3 Students will diagnose ABS electronic controls and components using self-diagnosis and/or recommended test equipment according to standard to determine needed repairs. (P1)</p> <p>2.4 Students will depressurize ABS high-pressure components following manufacturer's recommended safety procedures. (P2)</p> <p>2.5 Students will fill ABS master cylinders with recommended fluid following manufacturer's procedures and inspect for leaks. (P1)</p> <p>2.6 Students will bleed ABS front and rear hydraulic circuits following manufacturer's procedures. (P2)</p> <p>2.7 Students will perform a fluid pressure (hydraulic boost) diagnosis on a high pressure ABS according to standard to determine needed repairs. (P2)</p> <p>2.8 Students will remove and install ABS electrical/electronic/hydraulic components following manufacturer's procedures and specifications. (P3)</p> <p>2.9 Students will service, test, and adjust ABS speed sensors following manufacturer's recommended procedures. (P2)</p> <p>2.10 Students will diagnose, according to standard, ABS braking problems caused by vehicle modifications (e.g. tire size, curb height, final drive ratio). (P3)</p>	
Brakes	<p>3.0 Students will diagnose vacuum brake systems and will repair according to industry standards.</p> <p>3.1 Students will test pedal free travel with and without the engine running and check power booster operation according to</p>	Science Standard 1

	<p>standard. (P2)</p> <p>3.2 Students will check the vacuum supply (manifold or auxiliary pump) to vacuum-type power boosters with a vacuum gauge according to standard. (P2)</p> <p>3.3 Students will inspect vacuum-type power booster units for vacuum leaks, inspect the check valve for proper operation, and repair and replace parts, all according to standard. (P2)</p> <p>3.4 Students will inspect and test hydro-boost system and accumulator for leaks and proper operation according to standard to determine necessary action. (P3)</p>	
Brakes	<p>4.0 Students will perform wheel bearing diagnosis and repair according to industry standards.</p> <p>4.1 Students will diagnose wheel bearing noises, wheel shimmy and vibration problems according to standard to determine needed repairs. (P1)</p> <p>4.2 Students will remove, clean, inspect, repack, or replace and pack wheel bearings, replace seals and adjust wheel bearings according to standard. (P1)</p> <p>4.3 Students will replace wheel bearings and races according to standard. (P1)</p>	Science Standard 1
Brakes	<p>5.0 Students will perform parking brake diagnosis and repair according to industry standards.</p> <p>5.1 Students will check parking brake systems, inspect cables and parts for wear, rusting, binding and corrosion, lubricate assemblies, and clean or replace, all according to standard. (P2)</p> <p>5.2 Students will adjust parking brake assemblies and check operation according to standard. (P1)</p>	Science Standard 1
Brakes	<p>6.0 Students will diagnose brake-related electrical systems and will repair according to industry standards.</p> <p>6.1 Students will test parking brake indicator lights, switches, and wiring according to standard. (P3)</p>	Science Standard 1

	6.2 Students will test, adjust, repair or replace brake stop light switches and wiring according to standard. (P1)	
Electrical Systems	<p>1.0 Students will perform electrical circuit diagnosis and repair according to industry standards.</p> <p>1.1 Students will interpret wiring diagrams during diagnosis of electrical circuit problems. (P1)</p> <p>1.2 Students will check electrical circuits with a test light according to standard to determine needed repairs. (P2)</p> <p>1.3 Students will check voltage and voltage drop in electrical/electronic circuits using a digital multimeter (DMM) according to standard to determine needed repairs. (P1)</p> <p>1.4 Students will check current flow in electrical/electronic circuits and components using an ammeter according to standard to determine needed repairs. (P1)</p> <p>1.5 Students will check electrical circuits using jumper wires according to standard to determine needed repairs. (P2)</p> <p>1.6 Students will find shorts, grounds, opens, and resistance problems in electrical/electronic circuits according to standard to determine needed repairs. (P1)</p> <p>1.7 Students will measure and diagnose the causes of abnormal key-off battery drain according to standard to determine needed repairs. (P1)</p> <p>1.8 Students will inspect, test, and replace fusible links, circuit breakers and fuses according to standard. (P1)</p> <p>1.9 Students will inspect, test, repair and replace switches, connectors, relays, and wires of electrical/electronic circuits according to standard. (P1)</p> <p>1.10 Students will repair wiring harness and connectors according to standard. (P1)</p> <p>1.11 Students will perform solder repair of electrical wiring according to standard. (P1)</p> <p>1.12 Students will diagnose incorrect horn</p>	Science Standard 1 Math 6, 8

	operation and will repair according to standard. (P3)	
1.13	Students will diagnose incorrect wiper operation, diagnose wiper speed control and park problems, and will repair according to standard. (P3)	
1.14	Students will diagnose incorrect windshield washer operation and will repair according to standard. (P3)	
1.15	Students will diagnose incorrect operation of motor-driven accessory circuits and will repair according to standard. (P2)	
1.16	Students will diagnose incorrect heated glass operation and will repair according to standard. (P3)	
1.17	Students will diagnose incorrect electric door and hatch/trunk lock operation and will repair according to standard. (P3)	
1.18	Students will diagnose incorrect operation of cruise control systems and will repair according to standard. (P3)	
1.19	Students will diagnose supplemental restraint system (SRS) problems and will repair following manufacturer's safety procedures to prevent accidental deployment. (P3)	
1.20	Students will diagnose, according to standard, radio static and weak, intermittent, or no radio reception. (P3)	
1.21	Students will perform charging system output test according to standard to determine necessary action. (P1)	
1.21	Students will diagnose charging system problems that cause an undercharge, a no-charge or an overcharge condition according to standard. (P1)	
1.22	Students will remove and install alternator according to standard. (P2)	
1.23	Students will perform charging circuit voltage drop test according to standard to determine needed repairs. (P1)	
1.24	Inspect and adjust alternator drive belts and will replace according to standard. (P1)	
1.25	Inspect and test voltage regulator and will	

	<p>replace according to standard. (P2)</p> <p>1.26 Students will diagnose brighter than normal, intermittent, dim or no light operation according to standard. (P2)</p> <p>1.27 Students will inspect, replace, and aim headlights and bulbs according to standard. (P2)</p> <p>1.28 Students will inspect and diagnose incorrect turn signal or hazard light operation and will repair or replace according to standard. (P2)</p> <p>1.29 Students will diagnose intermittent, high, low or no gauge readings on instrument panels according to standard. (P2)</p> <p>1.30 Students will diagnose the cause of incorrect operation of warning devices and other driver information systems according to standard to determine necessary action. (P1)</p>	
Electrical Systems	<p>2.0 Students will perform battery diagnosis and service according to industry standards.</p> <p>2.1 Students will perform battery state-of-charge tests according to standard to determine needed service. (P1)</p> <p>2.2 Students will perform battery capacity (load, high-rate discharge) tests according to standard to determine needed service. (P1)</p> <p>2.3 Students will maintain or restore electronic memory functions. (P2)</p> <p>2.4 Students will inspect, clean, fill, and replace batteries according to standard. (P2)</p> <p>2.5 Students will perform slow/fast battery charges according to standard. (P2)</p> <p>2.6 Students will inspect, and clean, repair and replace battery cables, connectors, clamps, and hold-downs according to standard. (P1)</p> <p>2.7 Students will start a vehicle using jumper cables and a battery or auxiliary power supply according to standard. (P1)</p>	Science Standard 1
Electrical Systems	<p>3.0 Students will perform starter diagnosis and repair according to industry standards.</p> <p>3.1 Students will perform starter current draw</p>	Science Standard 1

	<p>and circuit voltage drop tests according to standard to determine needed repairs. (P1)</p> <p>3.2 Students will inspect, test and replace starter relays and solenoids according to standard. (P2)</p> <p>3.3 Students will remove and replace or reinstall starters according to standard. (P2)</p> <p>3.4 Students will perform starter bench tests according to standard to determine needed repairs. (P2)</p> <p>3.5 Students will inspect, test, repair and replace switches, connectors, and wires of starter control circuits according to standard. (P2)</p>	
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Auto Technology Learning Targets – Level II

Course Outline	CTE Knowledge & Skill Reference	Academic Standards
Safety Hand and Power Tools Shop Equipment	1.0 Students will apply safety procedures in the shop area when using all tools, equipment, chemicals and other materials according to standard (e.g., eye protection, fire safety, hand tool safety, machine and power tool safety and Right to Know).	Science Standard 1
	2.0 Students will perform specific jobs in the shop area related to various types of tools and equipment in a safe and effective manner.	Science Standard 1
Engine Performance	1.0 Students will diagnose general engine performance according to industry standards. 1.1 Students will interpret complaints to determine needed repairs. (P1) 1.2 Students will inspect engine assembly for fuel, oil, coolant, and other leaks to determine needed repairs. (P2) 1.3 Students will diagnose the cause of unusual exhaust color, odor, and sound according to standard to determine	Science Standard 1

	<p>needed repairs. (P2)</p> <p>1.4 Students will diagnose engine mechanical, ignition, or fuel problems using an oscilloscope and/or engine analyzer according to standard to determine needed repairs. (P1)</p> <p>1.5 Students will prepare 4 or 5 gas analyzers and inspect vehicle exhaust systems according to standard. (P1)</p> <p>1.6 Students will diagnose engine mechanical, ignition, fuel, or emissions control problems using a 4 or 5 gas analyzer according to standard to determine needed repairs. (P1)</p> <p>1.7 Students will perform analytic diagnostic procedures on a vehicle with on-board or self-diagnostic type computer systems according to standard to determine needed repairs. (P2)</p> <p>1.8 Students will inspect, test, adjust and replace sensor and actuator components and circuits of electronic engine management systems according to standard. (P2)</p> <p>1.9 Students will diagnose emissions and drivability problems resulting from failure of computerized engine controls with no diagnostic trouble codes stored according to standard to determine needed repairs. (P2)</p> <p>1.10 Students will retrieve and record stored diagnostic trouble codes and clear codes according to standard. (P1)</p> <p>1.11 Students will retrieve and record stored OBD II diagnostic trouble codes and clear codes according to standard. (P3)</p> <p>1.12 Students will diagnose the causes of emissions of drivability problems resulting from failure of computerized engine controls with stored diagnostic trouble codes and clear codes according to standard. (P1)</p> <p>1.13 Students will inspect, test, adjust, and replace computerized engine control</p>	
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	<p>system sensors, powertrain control module (PCM), actuators, and circuits according to standard. (P2)</p> <p>1.14 Students will diagnose emissions or drivability concerns resulting from failure of computerized engine controls with no stored diagnostic trouble codes according to standard to determine necessary action. (P1)</p> <p>1.15 Students will obtain and interpret digital multimeter (DMM) readings according to standard. (P1)</p> <p>1.16 Students will access and use electronic service information. (ESI) (P3)</p> <p>1.17 Students will locate and interpret vehicle and major component identification numbers (e.g. VIN, vehicle certification labels and calibration decals). (P1).</p> <p>1.18 Students will inspect and test power and ground circuits and connections and service or replace according to standard. (P1)</p> <p>1.19 Students will practice recommended precautions when handling static sensitive devices. (P2)</p> <p>1.20 Students will diagnose unusual engine noise and vibration according to standard to determine needed repairs. (P2)</p> <p>1.21 Students will perform engine absolute (vacuum/boost) manifold pressure tests according to standard to determine necessary action. (P1)</p> <p>1.22 Students will perform cylinder power balance tests according to standard to determine necessary action. (P1)</p> <p>1.23 Students will perform cylinder compression tests according to standard to determine necessary action. (P1)</p> <p>1.24 Students will perform cylinder leakage tests according to standard to determine necessary action. (P1)</p>	
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<p>Engine Performance</p>	<p>2.0 Students will diagnose ignition systems and will repair according to industry standards.</p> <p>2.1 Students will diagnose non-starting, hard starting, engine misfire, poor drivability, abnormal combustion, power loss, and poor mileage problems on vehicles with electronic distributor ignition systems according to standard to determine needed repairs. (P1)</p> <p>2.2 Students will inspect, test, repair, and replace ignition primary circuit wiring and components according to standard. (P2)</p> <p>2.3 Students will remove distributor, inspect, test, and service drives, shaft, bushings, cams, breaker plate, and vacuum, mechanical, and/or electrical advance/retard units and reinstall distributor according to standard. (P3)</p> <p>2.4 Students will inspect, test, service, repair and replace ignition system secondary circuit wiring and components according to standard.(P2)</p> <p>2.5 Students will inspect, test, and replace ignition coils according to standard. (P2)</p> <p>2.6 Students will check and adjust ignition timing and verify the timing advance according to standard. (P1)</p> <p>2.7 Students will inspect, test, and replace electronic wiring harnesses and connectors according to standard. (P3)</p> <p>2.8 Students will inspect and test ignition system pick-up sensors and triggering devices according to standard and will replace as needed. (P2)</p> <p>2.9 Students will inspect and replace electronic ignition system control units (modules) according to standard. (P2)</p> <p>2.10 Students will diagnose distributorless ignition system (DIS) operation according to standard and will service as required. (P1)</p>	<p>Science Standard 1</p>
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<p>Engine Performance</p>	<p>3.0 Students will diagnose fuel and exhaust systems and will repair according to industry standards.</p> <p>3.1 Students will diagnose no-starting, hard starting, poor idle, flooding hesitation, surging, engine misfire, power loss, poor mileage, and dieseling problems on vehicles with injection-type fuel systems according to standard to determine needed repairs. (P1)</p> <p>3.2 Students will inspect fuel tanks, fuel tank filters and fuel caps, inspect and replace fuel lines and hoses, and check fuel for contaminants according to standard. (P2)</p> <p>3.3 Students will inspect, test (pressure, vacuum, and volume), and replace fuel pumps, pump controls and inspect, service, and replace fuel filters according to standard. (P2)</p> <p>3.4 Students will inspect, clean, adjust, test, repair, and replace cold-enrichment systems according to standard. (P2)</p> <p>3.5 Students will remove and replace a fuel injection throttle body and adjust related linkages according to standard. (P2)</p> <p>3.6 Students will inspect, clean and replace a fuel injection air induction systems, intake manifolds, and gaskets according to standard. (P2)</p> <p>3.7 Students will check the idle speed on fuel injection systems according to standard. (P2)</p> <p>3.8 Students will inspect, test, clean, adjust, or replace components of fuel injection systems according to standard. (P2)</p> <p>3.9 Students will inspect and service air cleaners and element. according to standard (P2)</p> <p>3.10 Students will remove and replace fuel injectors according to standard. (P2)</p> <p>3.11 Students will remove and replace fuel tanks according to standard. (P3)</p> <p>3.12 Students will remove and replace fuel gauge sending units according to</p>	<p>Science Standard 1</p>
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	<p>standard. (P3)</p> <p>3.13 Students will test oxygen (O₂) sensors according to standard. (P1)</p> <p>3.14 Students will remove and replace/reinstall oxygen (O₂) sensors according to standard. (P2)</p> <p>3.15 Students will inspect, service, and replace/reinstall exhaust manifolds, exhaust pipes, mufflers, resonators, tail pipes and heat shields according to standard. (P2)</p> <p>3.16 Students will perform an exhaust system backpressure test according to standard to determine needed action. (P1)</p> <p>3.17 Students will test the operation of turbocharger systems according to standard to determine needed action. (P3)</p> <p>3.18 Students will remove, clean, inspect, and repair or replace turbocharger/supercharger system components according to standard. (P3)</p> <p>3.19 Students will identify the causes of turbocharger/supercharger failure according to standard to determine needed action. (P3)</p> <p>3.20 Students will replace fuel filters according to standard. (P1)</p>	
Engine Performance	<p>4.0 Students will diagnose positive crankcase ventilation (PVC) systems and will repair according to industry standards.</p> <p>4.1 Students will test the operation of PCV system according to standard to determine needed repairs. (P1)</p> <p>4.2 Students will inspect, test, service, and replace PCV valves, filters (breather cap), tubes and hoses according to standard. (P2)</p>	Science Standard 1
Engine Performance	<p>5.0 Students will diagnose idle speed control systems and will repair according to industry standards.</p> <p>5.1 Students will test the operation of idle speed control systems according to standard to determine needed repairs.</p>	Science Standard 1

	<p>(P2)</p> <p>5.2 Students will inspect, test, adjust, or replace sensors, solenoids, vacuum valves, motors, switches, circuits, and hoses of idle speed control system according to standard. (P2)</p>	
Engine Performance	<p>6.0 Students will diagnose exhaust gas recirculation (EGR) systems and will repair according to industry standards.</p> <p>6.1 Students will test the operation of EGR systems according to standard to determine needed repairs. (P1)</p> <p>6.2 Students will inspect, test, repair, or replace valves, valve manifolds, and exhaust passages of EGR systems according to standard. (P2)</p> <p>6.3 Students will inspect, test, repair, or replace vacuum/pressure controls, filters, and hoses of EGR systems according to standard. (P2)</p> <p>6.4 Students will inspect, test, repair, or replace electrical electronic controls and wiring of exhaust gas recirculation (EGR) systems according to standard. (P2)</p>	Science Standard 1
Engine Performance	<p>7.0 Students will perform exhaust gas treatment (air injection reaction) diagnosis and repair according to industry standards.</p> <p>7.1 According to standard, students will diagnose emissions and drivability problems resulting from failure of the secondary air injection and catalytic converter systems. (P2)</p> <p>7.2 Students will inspect and test mechanical components of secondary air injection systems and service according to standard and will replace as needed. (P2)</p> <p>7.3 Students will inspect and test electrical/electronically-operated components and circuits of air injection systems according to standard and will replace as needed. (P2)</p> <p>7.4 Students will inspect and test components of catalytic converter systems according</p>	Science Standard 1

	to standard and will replace as needed. (P2)	
Engine Performance	<p>8.0 Students will diagnose inlet air temperature control systems and will repair according to industry standards.</p> <p>8.1 Students will diagnose emission and drivability problems resulting from failure of the intake air temperature control system according to standard to determine necessary action. (P3)</p> <p>8.2 Students will inspect and test components of intake air temperature control system according to standard and will perform necessary action. (P3)</p>	Science Standard 1
Engine Performance	<p>9.0 Students will diagnose intake manifold heat control systems and will repair according to industry standards.</p> <p>9.1 Students will diagnose emissions and drivability problems resulting from failure of early fuel evaporation control system according to standard to determine necessary action. (P3)</p> <p>9.2 Students will inspect and test components of early fuel evaporation control system according to standard and will perform necessary action. (P3)</p>	Science Standard 1
Engine Performance	<p>10.0 Students will diagnose fuel vapor control systems and will repair according to industry standards.</p> <p>10.1 Students will diagnose emissions and drivability problems resulting from failure of evaporative emissions control system according to standard to determine necessary action. (P2)</p> <p>10.2 Students will inspect and test components and hoses of evaporative emissions control system according to standard and will perform necessary action. (P2)</p>	Science Standard 1
Engine Performance	<p>11.0 Students will perform engine-related service according to industry standards.</p> <p>11.1 Students will adjust valves on engines with mechanical or hydraulic lifters according to standard. (P1)</p> <p>11.2 Students will verify correct valve timing</p>	Science Standard 1

	<p>according to standard to determine needed repairs. (P1)</p> <p>11.3 Students will verify engine operating temperature according to standard to determine needed action. (P1)</p> <p>11.4 Students will perform cooling system pressure tests, check coolant condition, inspect and test radiators, pressure caps, coolant recovery tanks, hoses and will service and replace according to standard. (P1)</p> <p>11.5 Students will inspect and test thermostat bypasses, and housing, according to standard and will replace as needed. (P1)</p> <p>11.6 Students will inspect and test mechanical/electrical fans, fan clutches, fan shrouds/ducting, air dams, fan control devices and service according to standard and will replace as needed. (P2)</p>	
Suspension and Steering	<p>1.0 Students will diagnose steering suspension systems and will repair according to industry standards.</p> <p>1.1 Students will disable a supplemental restraint system (SRS) according to manufacturer's procedures. (P1).</p> <p>1.2 Students will remove and replace steering wheel-center/time SRS coil according to standard. (P1)</p> <p>1.3 Students will diagnose steering column noises, looseness, and binding problems according to standard to determine needed repairs. (P3)</p> <p>1.4 Students will diagnose power steering gear (non-rack and pinion type) binding, uneven turning effort, looseness, hard steering, and fluid leakage problems according to standard to determine needed repairs (P3)</p> <p>1.5 Students will diagnose manual steering gear (non-rack and pinion type) binding, uneven turning effort, looseness, hard steering, and fluid leakage problems according to standard to determine needed repairs. (P3)</p>	Science Standard 1

	<p>1.6 Students will diagnose power rack and pinion steering gear vibration, looseness, and hard steering problems according to standard to determine needed repairs. (P3)</p> <p>1.7 Students will inspect and replace steering shaft universal joints, flexible couplings, and steering wheels according to standard. (P2)</p> <p>1.8 Students will remove and replace manual/power steering gears (non-rack and pinion type) according to standard. (P2)</p> <p>1.9 Students will adjust manual/power steering gears (non-rack and pinion type), worm bearing preload, and sector lash according to standard. (P3)</p> <p>1.10 Students will remove and replace manual/power rack and pinion steering gears according to standard. (P2)</p> <p>1.11 Students will adjust manual/power rack and pinion steering gears according to standard. (P3)</p> <p>1.12 Students will inspect and replace manual/power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots according to standard. (P2)</p> <p>1.13 Students will inspect and replace rack and pinion gear mounting bushings and brackets according to standard. (P2)</p> <p>1.14 Students will inspect manual and power steering fluid levels and conditions according to standard. (P1)</p> <p>1.15 Students will flush power steering systems according to standard. (P2)</p> <p>1.16 Students will diagnose power steering fluid leakage according to standard to determine needed repairs. (P2)</p> <p>1.17 Students will inspect, adjust, and replace power steering pump belts according to standard. (P1)</p> <p>1.18 Students will remove and replace power steering pumps and inspect pump mounts according to standard. (P2)</p>	
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	<p>1.19 Students will inspect and replace power steering pump seals and gaskets according to standard. (P3)</p> <p>1.20 Students will perform steering system pressure tests according to standard to determine needed repairs. (P2)</p> <p>1.21 Students will inspect and replace power steering hoses and fittings according to standard. (P2)</p> <p>1.22 Students will inspect and replace power steering gears (non-rack and pinion type) seals and gaskets according to standard.</p> <p>1.23 Students will inspect and replace pitman arm relay (centerlink/intermediate) rods, idler arms and mountings and steering linkage dampers according to standard. (P3)</p> <p>1.24 Students will inspect, replace, and adjust tie rod ends (sockets) tie rod sleeves, and clamps according to standard. (P2)</p> <p>1.25 Students will diagnose, inspect, adjust, repair or replace components of electronically controlled steering systems according to standard. (P3)</p>	
Suspension and Steering	<p>2.0 Students will diagnose suspension systems and will repair according to industry standards.</p> <p>2.1 Students will diagnose short and long arm suspension system noises, body sway, and uneven riding height problems according to standard to determine needed repairs. (P1)</p> <p>2.2 Students will diagnose Macpherson strut suspension system noises, body sway, and uneven riding height problems according to standard to determine needed repairs. (P1)</p> <p>2.3 Students will remove, inspect, and replace upper and lower control arms, bushings shafts, and rebound bumpers according to standard. (P2)</p> <p>2.4 Students will remove, inspect, replace and adjust strut (compression/tension) rods and bushings according to standard. (P2)</p>	Science Standard 1

	<p>2.5 Students will remove, inspect, and replace upper and lower ball joints on short and long arm suspension systems according to standard. (P2)</p> <p>2.6 Students will remove, inspect, and replace steering knuckle assemblies according to standard. (P2)</p> <p>2.7 Students will remove, inspect, and replace short and long arm suspension system coil springs and spring insulators according to standard. (P2)</p> <p>2.8 Students will remove, inspect, replace, and adjust suspension system torsion bars and inspect mounts according to standard. (P3)</p> <p>2.9 Students will remove, inspect, and replace stabilizer bar bushings, brackets, and links according to standard. (P3)</p> <p>2.10 Students will remove, inspect, and replace ball joints on Macpherson strut suspension systems according to standard. (P2)</p> <p>2.11 Students will remove, inspect, and replace Macpherson strut cartridges or assemblies, strut coil springs, insulators, upper strut bearing mounts and upper strut bearing mounts according to standard. (P1)</p> <p>2.12 Students will lubricate suspension and steering systems according to standard. (P2)</p> <p>2.13 Students will inspect, remove, and replace shock absorbers according to standard. (P1)</p> <p>2.14 Students will remove, inspect, and service or replace front and rear wheel bearings according to standard. (P1)</p> <p>2.15 Students will diagnose, inspect, adjust, repair or replace components of electronically controlled suspension systems according to standard. (P2)</p>	
Suspension and Steering	3.0 Students will diagnose rear suspension systems diagnosis and will repair according to industry standards.	Science Standard 1

	<p>3.1 Students will inspect and replace rear suspension system transverse links, control arms, coil springs, bushings, and mounts according to standard. (P2)</p> <p>3.2 Students will inspect and replace rear suspension system leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts. (P3)</p> <p>3.3 Students will inspect and replace rear Macpherson strut cartridges or assemblies. (P2)</p>	
Suspension and Steering	<p>4.0 Students will diagnose wheel alignment systems diagnosis and will repair according to industry standards.</p> <p>4.1 Students will diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return problems according to standard to determine needed repairs. (P1)</p> <p>4.2 Students will perform pre-alignment inspection according to standard. (P1)</p> <p>4.3 Students will measure vehicle riding height according to standard to determine needed repairs. (P1)</p> <p>4.4 Students will check and adjust front and rear wheel camber according to standard to determine needed repairs. (P1)</p> <p>4.5 Students will check and adjust front wheel toe according to standard. (P1)</p> <p>4.6 Students will center the steering wheel according to standard. (P1)</p> <p>4.7 Students will check toe-out-on-turns (turning radius) according to standard to determine needed repairs. (P2)</p> <p>4.8 Students will check SAI (steering axis inclination) and included angle according to standard to determine needed repairs. (P2)</p> <p>4.9 Students will check and adjust rear wheel toe according to standard. (P2)</p> <p>4.10 Students will check rear wheel thrust angle according to standard to determine needed repairs. (P2)</p> <p>4.11 Students will check for front wheel</p>	Science Standard 1

	<p>setback according to standard to determine needed repairs. (P2)</p> <p>4.12 Students will check front cradle (subframe) alignment according to standard to determine needed repairs. (P3)</p> <p>4.13 Students will diagnose tire wear patterns according to standard to determine needed repairs. (P1)</p> <p>4.14 Students will inspect tires and check and adjust air pressure according to standard. (P1)</p> <p>4.15 Students will diagnose wheel/tire vibration, shimmy, and noise problems according to standard to determine needed repairs. (P2)</p> <p>4.16 Students will rotate tires according to manufacturer's recommendations. (P1)</p> <p>4.17 Students will measure wheel, tire axle, and hub runout according to standard to determine needed repairs. (P2)</p> <p>4.18 Students will diagnose tire pull (lead) problems according to standard to determine corrective actions. (P2)</p> <p>4.19 Students will balance wheel and tire assemblies (static and dynamic) according to standard. (P1)</p> <p>4.20 Students will dismount, inspect, repair, and remount tires on wheels according to standard. (P2)</p> <p>4.21 Students will reinstall wheel and torque lug nuts according to standard. (P1)</p>	
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Auto Technology Learning Targets – Level III

Course Outline	CTE Knowledge & Skill Reference	Academic Standards
Safety Hand and Power Tools Shop Equipment	1.0 Students will apply safety procedures in the shop area when using all tools, equipment, chemicals and other materials according to standard (e.g.,	Science Standard 1 ELA 3

	eye protection, fire safety, hand tool safety, machine and power tool safety and Right to Know).	
	2.0 Students will perform specific jobs in the shop area related to various types of tools and equipment in a safe and effective manner.	Science Standard 1
Manual Drive Train and Axles	<p>1.0 Students will perform clutch diagnosis and repair according to industry standards.</p> <p>1.1 Students will diagnose clutch noise, binding, slippage, pulsation, chatter problems according to standard to determine needed repairs. (P1)</p> <p>1.2 Students will inspect, adjust, and replace clutch pedal linkages, cables and automatic adjuster mechanisms, brackets, bushings, pivots, and springs according to standard. (P1)</p> <p>1.3 Students will inspect, adjust, repair and replace hydraulic clutch slaves and master cylinders, lines, and hoses according to standard. (P1)</p> <p>1.4 Students will inspect, adjust and replace release (throw-out) bearings, levers and pivots according to standard. (P1)</p> <p>1.5 Students will inspect and replace clutch pressure plate assemblies and clutch discs according to standard. (P1)</p> <p>1.6 Students will inspect, remove and replace crankshaft pilot bearing/bushings according to standard. (P1)</p> <p>1.7 Students will inspect and repair flywheel and ring gear according to standard. (P1)</p> <p>1.8 Students will inspect engine blocks, clutch (bell) housings and transmission case mating surfaces according to standard to determine needed repairs. (P3)</p>	Science Standard 1
Manual Drive Train and Axles	<p>2.0 Students will perform transmission diagnosis and repair according to industry standards.</p> <p>2.1 Students will remove and reinstall</p>	Science Standard 1

	<p>transmissions and transaxles according to standard. (P2)</p> <p>2.2 Students will disassemble, clean, and reassemble transmission and transaxle components according to standard. (P2)</p> <p>2.3 Students will inspect transmission and transaxle cases, extension housings, case mating surfaces, bores, bushings, and vents according to standard and will perform necessary action. (P3)</p> <p>2.4 Students will diagnose noise, hard shifting, jumping out of gear, and fluid leakage concerns according to standard to determine necessary action. (P3)</p> <p>2.5 Students will inspect, adjust, and reinstall shift linkages, brackets, bushings, cables, pivots and levers according to standard. (P3)</p> <p>2.6 Students will inspect and reinstall powertrain mounts according to standard. (P3)</p> <p>2.7 Students will inspect and replace gaskets, seals, and sealants, and will inspect sealing surfaces, all according to standard. (P2)</p> <p>2.8 Students will remove and replace transaxle final drives according to standard. (P3)</p> <p>2.9 Students will inspect, adjust, and reinstall shift covers, forks, levers, grommets, shafts, sleeves, detent mechanisms, interlocks, and springs according to standard. (P2)</p> <p>2.10 Students will measure endplay or preload (shim or spacer selection procedures) on transmission and transaxle shafts according to standard and will perform necessary action. (P1)</p> <p>2.11 Students will inspect and reinstall synchronizer hubs, sleeves, keys (inserts), springs, and blocking rings according to standard. (P2)</p> <p>2.12 Students will inspect and reinstall speedometer drive gears, driven gears,</p>	
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	<p>vehicle speed sensors (VSS), and retainers according to standard. (P2)</p> <p>2.13 Students will diagnose transaxle final drive assembly noise and vibration concerns according to standard to determine necessary action. (P3)</p> <p>2.14 Students will remove, inspect, measure, adjust, and reinstall transaxle final drive pinion gears (spiders), shafts, side gears, side bearings, thrust washers, and case assemblies according to standard. (P2)</p> <p>2.15 Students will inspect lubrication devices (oil pump or slingers) according to standard and will perform necessary action. (P3)</p> <p>2.16 Students will inspect, test, and replace transmission and transaxle sensors and switches according to standard. (P1)</p>	
Manual Drive Train and Axles	<p>3.0 Students will perform drive shaft and universal joint diagnosis and repair according to industry standards.</p> <p>3.1 Students will diagnose front wheel drive (FWD) and rear wheel drive (RWD) shaft and universal/constant-velocity (CV) joint noise and vibration problems according to standard to determine needed repairs. (P2)</p> <p>3.2 Students will diagnose FWD front wheel bearing noise and vibration problems according to standard to determine needed repairs. (P2)</p> <p>3.3 Students will inspect, service, and replace FWD and RWD shafts, yokes, boots, and universal/CV joints according to standard. (P1)</p> <p>3.4 Students will check shaft runout and driveline angle according to standard to determine needed repairs. (P3)</p>	Science Standard 1
Manual Drive Train and Axles	<p>4.0 Students will perform ring and pinion gears/differential case assembly diagnoses and repair according to industry standards.</p> <p>4.1 Students will diagnose noise and</p>	Science Standard 1 Math 1

	<p>vibration concerns according to standard to determine necessary action. (P2)</p> <p>4.2 Students will diagnose fluid leakage concerns according to standard to determine necessary action. (P2)</p> <p>4.3 Students will inspect and replace companion flange and pinion seal and will measure companion flange runout, all according to standard. (P2)</p> <p>4.4 Students will inspect ring gear and measure runout according to standard to determine necessary action. (P2)</p> <p>4.5 Students will remove, inspect, and reinstall drive pinion and ring gear, spacers, sleeves, and bearings according to standard. (P2)</p> <p>4.6 Students will measure and adjust drive pinion depth according to standard. (P2)</p> <p>4.7 Students will measure and adjust drive pinion bearing preload according to standard. (P1)</p> <p>4.8 Students will measure and adjust side bearing preload and ring and pinion gear total backlash variation on a differential carrier assembly (threaded cup or shim types) according to standard. (P2)</p> <p>4.9 Students will check ring and pinion tooth contact patterns according to standard and will perform necessary action. (P1)</p> <p>4.10 Students will disassemble, inspect, measure, and adjust or replace differential pinion gears (spiders), shafts, side gears, side bearings, thrust washers, and cases according to standard. (P2)</p> <p>4.11 Students will reassemble and reinstall differential case assembly according to standard and will measure runout according to standard to determine necessary action. (P2)</p>	
Manual Drive Train and Axles	<p>5.0 Students will perform limited slip differential diagnosis and repair according to industry standards.</p> <p>5.1 Students will diagnose noise, slippage,</p>	Science Standard 1

	<p>and chatter problems according to standard to determine needed repairs. (P3)</p> <p>5.2 Students will inspect and flush differential housings and refill with the correct lubricant according to standard. (P2)</p> <p>5.3 Students will inspect, adjust, and replace clutch (cone/plate) components according to standard. (P3)</p> <p>5.4 Students will measure rotating torque at a rear wheel according to standard to determine needed repairs. (P3)</p>	
Manual Drive Train and Axles	<p>6.0 Students will perform axle shaft diagnosis and repair according to industry standards.</p> <p>6.1 Students will diagnose rear axle shafts, bearings and seals for noise, vibration, and fluid leakage problems according to standard to determine needed repairs. (P2)</p> <p>6.2 Students will inspect and replace rear axle shaft wheel studs according to standard. (P2)</p> <p>6.3 Students will remove and replace rear axle shafts according to standard. (P1)</p> <p>6.4 Students will inspect and replace rear axle shaft seals, bearings, and retainers according to standard. (P2)</p> <p>6.5 Students will replace axle shaft bearings (pressed-on type) according to standard. (P2)</p> <p>6.6 Students will measure rear axle flange runout and shaft endplay according to standard to determine needed repairs. (P2)</p>	Science Standard 1 Math 1
Manual Drive Train and Axles	<p>7.0 Students will perform four-wheel drive component diagnosis and repair according to industry standards.</p> <p>7.1 Students will diagnose noise, vibration, and unusual steering concerns according to standard to determine necessary action. (P3)</p> <p>7.2 Students will inspect, adjust and repair</p>	Science Standard 1

	<p>shifting controls (mechanical, electrical, and vacuum), bushings, mounts, levers, and brackets according to standard. (P3)</p> <p>7.3 Students will remove and reinstall transfer cases according to standard. (P3)</p> <p>7.4 Students will disassemble, service, and reassemble transfer cases and components according to standard. (P3)</p> <p>7.5 Students will inspect front-wheel bearings and locking hubs according to standard and will perform necessary action. (P3)</p> <p>7.6 Students will check drive assembly seals and vents and lube levels according to standard. (P3)</p> <p>7.7 Students will diagnose test, adjust, and replace electrical/electronic components of four-wheel drive systems according to standard. (P3)</p>	
Heating & Air Conditioning	<p>1.0 Students will perform heating and air conditioning maintenance and repair according to industry standards.</p> <p>1.1 Students will diagnose unusual operating noises in the A/C system according to standard to determine needed repairs. (P2)</p> <p>1.2 Students will conduct a performance test of the A/C system according to standard to determine needed repairs. (P1)</p> <p>1.3 Students will leak test A/C systems according to standard to determine needed repairs. (P1)</p> <p>1.4 Students will inspect the condition of discharged oil according to standard. (P2)</p> <p>1.5 Students will select oil type and measure and add oil to the A/C system according to standard. (P2)</p> <p>1.6 Students will diagnose A/C system problems according to standard that cause the protection devices (pressure, thermal, and PCM) to interrupt system</p>	<p>Science Standard 1 Math 1</p>

	<p>operation in order to determine needed repairs. (P2)</p> <p>1.7 Students will inspect A/C compressor drive belts and replace according to standard. (P2)</p> <p>1.8 Students will inspect, test, and replace A/C compressor clutch components or assembly according to standard. (P2)</p> <p>1.9 Students will remove and replace A/C compressors and mountings according to standard. (P2)</p> <p>1.10 Students will remove, inspect, and replace A/C system mufflers, hoses, lines, fittings, o-rings, seals, and service valves according to standard. (P2)</p> <p>1.11 Students will inspect A/C condenser for airflow restrictions and service same according to standard. (P1)</p> <p>1.12 Students will inspect and replace receiver/driers or accumulator/driers according to standard. (P2)</p> <p>1.13 Students will inspect, test, and replace expansion valves or orifice (expansion) tubes according to standard. (P2)</p> <p>1.14 Students will inspect and repair evaporator housing water drains according to standard. (P3)</p> <p>1.15 Students will diagnose temperature control problems in the heater/ventilation system according to standard to determine needed repairs. (P2)</p> <p>1.16 Students will clean, inspect, test and replace fans, fan clutches (electrical and mechanical) fan shrouds, and air dams according to standard. (P2)</p> <p>1.17 Students will inspect, test, and replace heat control valves according to standard. (P3)</p> <p>1.18 Students will diagnose failures in the electrical controls of heating and A/C systems according to standard to determine needed repairs. (P2)</p> <p>1.19 Students will inspect, test, repair and</p>	
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	<p>replace A/C heater blowers, motors, resistors, switches, relays, wiring, and protection devices according to standard. (P2)</p> <p>1.20 Students will diagnose failures in the vacuum and mechanical controls of the heating and A/C system according to standard to determine needed repairs. (P2)</p> <p>1.21 Students will verify correct operation and maintenance of refrigerant handling equipment according to standard. (P1)</p> <p>1.22 Students will identify and recover A/C system refrigerant according to standard. (P1)</p> <p>1.23 Students will recycle refrigerant according to standard. (P1)</p> <p>1.24 Students will label and store refrigerant according to standard. (P1)</p> <p>1.25 Students will test recycled refrigerant for non-condensable gases according to standard. (P1)</p> <p>1.26 Students will evacuate and charge A/C systems according to standard. (P1)</p> <p>1.27 Students will perform cooling system, cap, and recovery systems tests (e.g. pressure, combustion leakage, and temperature) according to standard to determine needed repairs. (P1)</p> <p>1.28 Students will inspect engine cooling and heater system hoses and belts and will replace, all according to standard. (P1)</p> <p>1.29 Students will inspect, test, and replace thermostat and housing according to standard. (P1)</p> <p>1.30 Students will determine coolant condition and drain and recover coolant according to standard. (P1)</p> <p>1.31 Students will bleed and flush systems and refill with recommended coolant according to standard. (P1)</p> <p>1.32 Students will diagnose A/C system problems caused by too much moisture in the refrigerant according to standard.</p>	
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	<p>(P3)</p> <p>1.33 Students will inspect and test electric fan control system and circuits according to standard. (P1)</p> <p>1.34 Students will test A/C compressor load cut-off systems according to standard to determine necessary action. (P3)</p>	
Automatic Transmission and Transaxle	<p>1.0 Students will perform automatic transmission and transaxles diagnosis and repair according to industry standards.</p> <p>1.1 Students will interpret and verify driver's complaints and verify proper engine operation according to standard to determine needed repairs. (P1)</p> <p>1.2 Students will diagnose unusual fluid usage, fluid levels, and condition problems according to standard to determine needed repairs. (P1)</p> <p>1.3 Students will perform pressure tests according to standard to determine needed repairs. (P1)</p> <p>1.4 Students will perform stall tests according to standard to determine needed repairs. (P2)</p> <p>1.5 Students will perform lock-up converter system tests according to standard to determine needed repairs. (P2)</p> <p>1.6 Students will diagnose noise and vibration problems according to standard to determine needed repairs. (P3)</p> <p>1.7 Students will inspect, adjust and replace manual shift valves and throttle (TV) linkages or cables and check gear select indicators according to standard. (P1)</p> <p>1.8 Students will service transmissions, perform visual inspections, and replace fluids and filters according to standard. (P1)</p> <p>1.9 Students will inspect, adjust and replace vacuum modulators, and inspect, repair and replace lines and hoses according to standard. (P3)</p>	<p>Science Standard 1</p> <p>Math 1</p>

	<p>1.10 Students will inspect, repair, and replace governor assemblies according to standard. (P3)</p> <p>1.11 Students will inspect and replace external seals and gaskets according to standard. (P3)</p> <p>1.12 Students will inspect extension housings and replace bushings and seals according to standard. (P3)</p> <p>1.13 Students will conduct leak tests, and flush and replace cooler lines and fittings according to standard. (P1)</p> <p>1.14 Students will inspect and replace speedometer drive gears, drive gears, vehicle speed sensors (VSS) and retainers according to standard. (P3)</p> <p>1.15 Students will inspect, test, adjust, repair and replace transmission related electrical and electronic components (e.g., computers, solenoids, sensors, relays, switches, and harnesses) according to standard. (P2)</p> <p>1.16 Students will inspect, replace, and align power train mounts according to standard. (P3)</p> <p>1.17 Students will remove and reinstall transmission and torque converters (rear-wheel drive) according to standard. (P2)</p> <p>1.18 Students will remove and reinstall transaxles and torque converter assemblies according to standard. (P2)</p> <p>1.19 Students will disassemble, clean, and inspect transmissions and transaxles according to standard. (P1)</p> <p>1.20 Students will assemble transmission and transaxles according to standard. (P1)</p> <p>1.21 Students will inspect converter flex plates, attaching parts, pilot and pump drives, and seal areas according to standard. (P2)</p> <p>1.22 Students will measure torque converter endplay, check for interference, and check the stator clutch according to</p>	
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	<p>standard. (P2)</p> <p>1.23 Students will check torque converters and transmission cooling systems for contamination according to standard. (P1)</p> <p>1.24 Students will check endplay or pre-load in gear trains according to standard to determine needed service. (P1)</p> <p>1.25 Students will inspect, measure, and replace thrust washers and bearings according to standard. (P2)</p> <p>1.26 Students will inspect oil delivery seal rings, ring grooves, and sealing surface areas according to standard. (P2)</p> <p>1.27 Students will inspect bushings and replace according to standard. (P2)</p> <p>1.28 Students will inspect and measure planetary gear assembly (to include sun, ring gear, thrust washers, planetary gears, and carrier assembly) and replace, all according to standard. (P2)</p> <p>1.29 Students will inspect cases, bores, passages, bushings, vent and mating surfaces and replace, all according to standard. (P2)</p> <p>1.30 Students will inspect transaxle drives, link chains, sprockets, gears, bearings, and bushings and replace, all according to standard. (P2)</p> <p>1.31 Students will inspect, measure, repair, adjust or replace transaxle final drive components according to standard. (P2)</p> <p>1.32 Students will inspect and reinstall parking pawls, shaft springs and retainers and replace, all according to standard. (P3)</p> <p>1.33 Students will inspect clutch drums, pistons, check-balls, springs, retainers, seals, and friction and pressure plates and replace, all according to standard. (P2)</p> <p>1.34 Students will measure clutch pack clearance according to standard. (P1)</p> <p>1.35 Students will air test operation of clutch</p>	
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	<p>and servo assemblies according to standard. (P1)</p> <p>1.36 Students will inspect roller and sprag clutches, races, rollers, sprags, springs, cages, and retainers and replace, all according to standard. (P2)</p> <p>1.37 Students will inspect bands and drums and replace, all according to standard. (P3)</p>	
Cooperative Work Experience	1.0 Students demonstrate readiness to apply skills learned in the classroom by performing a cooperative work assignment at local automotive repair facilities.	Science Standard 1

Technical Related Courses

In addition to the required academic and vocational courses, students in this career area will take the following technical related courses:

- Electricity Fundamentals
- Schematic Reading (Hodgson only)
- Related Math

Materials/Equipment

The following materials and/or equipment are required for students in this career area. Some items may vary depending on location.

- Auto Tech uniform pants and shirt
- Student tool set
- Proper eye protection
- Leather-type work shoes or boots

Curriculum Alignments & Articulations

The NCCVT Auto Technology program has curriculum aligned with the following institutions. In some cases students can receive post-secondary credit for courses taken as part of the high school career area program of study.

- Automotive Training Center
- Delaware Technical & Community College
- Nashville Auto Diesel College, Ohio Diesel
- Pennco Tech, Universal Technical Institute
- Wyoming Technical College

APPENDIX

Career Advisory Committee

Career Program Data

Career Program of Study

AUTO TECHNOLOGY

Delcastle Technical High School

Hodgson Voc. Technical High School

St. Georges Technical High School

Grade 9

MATH (M)		ENGLISH (ELA)	
3140 Math Concepts	1	2210 English	1
3150 Math Applications	1	2110 English	1
3170 Algebra	1	_____	_____
3710 Algebra	1	_____	_____
3300 Integrated Math 1	1	_____	_____
3400 Integrated Math 2	1	_____	_____
3500 Integrated Math 3	1	_____	_____

SCIENCE (S)		SOCIAL STUDIES (SS)	
4200 Physical Science	1	5200 Global Studies	1
4110 Physical Science	1	5110 Global Studies	1
_____	_____	_____	_____

VOCATIONAL and OTHER COURSES

1910 T. C. Exploration	2	_____	_____
3200 PASS Math	0.5	2200 PASS Literacy	0.5
3100 PASS Math	0.5	2100 PASS Literacy	0.5

Note: The grade in which **Health** and **Physical Education** are offered varies from school to school.

Grade 10

MATH (M)		ENGLISH (ELA)	
3150 Math Applications	1	2220 English	1
3170 Algebra	1	2120 English	1
3300 Integrated Math 1	1	_____	_____
3400 Integrated Math 2	1	_____	_____
3500 Integrated Math 3	1	_____	_____

SCIENCE (S)		SOCIAL STUDIES (SS)	
4300 Biology	1	5300 Civics/Economics	1
4120 Biology	1	5120 Civics/Economics	1
_____	_____	_____	_____

VOCATIONAL and OTHER COURSES

(3 VOCATIONAL CREDITS ARE REQUIRED.)

1422 Auto Tech 1	2	Driver Education	_____
_____ P.E. / Health	_____	_____ Spanish I or II	1

Grade 11

MATH (M)		ENGLISH (ELA)	
3170 Algebra	1	2230 English	1
3400 Integrated Math 2	1	2130 English	1
3500 Integrated Math 3	1	2235 Honors English	1
3750 Intermediate Algebra	1	_____	_____
3820 Stat/Algebra	1	_____	_____

SCIENCE (S)		SOCIAL STUDIES (SS)	
4400 Integrated Science	1	5400 U.S. History	1
4170 Integrated Science	1	5130 U.S. History	1
4500 Chemistry*	1	_____	_____
4600 Physics*	1	_____	_____

VOCATIONAL and OTHER COURSES

(3 VOCATIONAL CREDITS ARE REQUIRED.)

1423 Auto Tech 2	3	_____	_____
_____ P.E. / Health	_____	_____ Spanish I or II	1

(PR) Denotes a program requirement

* Denotes prerequisites must be met in order to enroll.

Grade 12

MATH (M)		ENGLISH (ELA)	
3310 Integrated Math I CT	1	2240 English	1
3500 Integrated Math 3	1	2140 English	1
3750 Intermediate Algebra	1	2245 Honors English	1
3820 Stat/Algebra	1	2245 Co-op English	1
3950 Pre Calculus A	1	_____	_____
3960 Pre Calculus B	1	_____	_____
_____ 9 Co-op	_____	_____	1

SCIENCE (S)		SOCIAL STUDIES (SS)	
4500 Chemistry*	1	5500 World History*	1
4600 Physics*	1	5600 Cont. Citizenship	1
4700 Environmental Sci.*	1	5910 Law & Order	0.5
4130 Environmental Sci.*	1	5810 Intro. to Sociology	0.5
_____ 9 Co-op	_____	5920 Intro. to Psychology	0.5
_____	_____	_____ 9 Co-op	_____

VOCATIONAL and OTHER COURSES

(3 VOCATIONAL CREDITS ARE REQUIRED.)

1424 Auto Tech 3	3	_____	_____
_____ P.E. / Health	_____	_____ Spanish I or II	1

Graduation Requirements:

Total = 24.5/26.5

Vocational = 9/10 credits

ELA = 4 credits

M = 3/4 credits

SS = 3/4 credits, to include U.S. History

S = 3/4 credits, to include Biology & a physical science

Health = 0.5 credits

Phys. Ed. = 1.0 credits

NCCVT School District

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District MISSION STATEMENT

The New Castle County Vocational-Technical School District is dedicated to the development of competent, caring and productive students for a diverse and changing society through high standards, quality teaching, instructional technology, and community partnerships.

9/4/09



