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CTE Standards Unpacking
Maintenance and Light Repair

Course: Maintenance and Light Repair
Course Description: This is an entry level course where students will learn basic maintenance procedures and safe work practices. The desire for the students to receive industry-based training at the basic level and step up to the higher level of competency in this field is the ultimate goal of this course. Students who complete this course should be able to test for their ASE certification in this field.
Career Cluster: Transportation, Distribution & Logistics
Prerequisites: Any foundation course – Maintenance and Light Repair (MLR) – Any advanced course
Program of Study Application: Maintenance and Light Repair is a cluster course in the transportation, distribution and logistics career cluster. Success in Maintenance and Light Repair will prepare a student to enter any of the pathways in the cluster.

INDICATOR #MLR 1: **Students will demonstrate safety practices for automotive repair.**		
SUB-INDICATOR 1.1 (Webb Level: 2 Skill/Concept): Identify and demonstrate general shop safety rules and procedures using Occupational Safety and Health Administration (OSHA) standards		
Knowledge (Factual): -OSHA safety rules and procedures -Use of personal safety equipment -Safety data sheets (SDS) -Building safety guidelines -Emergency safety equipment location -First aid station location	**Understand (Conceptual):** -Importance of following all shop safety rules and using personal safety equipment	**Do (Application):** -Examine basic shop safety using OSHA standards -Utilize proper ventilation procedures for working within the lab/shop area -Identify marked safety areas -Identify location and types of fire extinguishers and other fire safety equipment -Identify location and use of eyewash stations

		-Identify location of posted evacuation routes -Demonstrate knowledge of industry requirements for personal protective clothing and equipment -Identify and wear proper clothing, hair styles and jewelry for lab/shop activities -Locate and demonstrate knowledge of safety data sheets (SDS)

Benchmarks:
Students will be assessed on their ability to:

- Pass OHSA safety test

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience HS	Students will write an explanation of different types of fire extinguishers and explain proper use.
-PS3-4 Plan and carry out an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system	Students will explain the impacts of various extinguishers and the effect that occurs on various fires

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INDICATOR #MLR 2: **Students will demonstrate an understanding of the safe and appropriate use of tools and equipment.**		
SUB-INDICATOR 2.1 (Webb Level: 2 Skill/Concept): Utilize safe procedures for handling of tools and equipment		
Knowledge (Factual): -Correct and safe use of tools and equipment	**Understand (Conceptual):** -Avoid injury or damage to property	**Do (Application):** -Identify and use proper placement of floor jacks and jack stands -Identify and use proper procedures for safe lift operation -Demonstrate awareness of the safety aspects of high voltage circuits (such as high intensity discharge [HID] lamps, ignition systems, injection systems, etc.)
Benchmarks: *Students will be assessed on their ability to:* • Follow shop safety guidelines. • Demonstration of equipment		
Academic Connections		
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	**Sample Performance Task Aligned to the Academic Standard(s):** Students will discuss the consequences of not following safety procedures	

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INDICATOR #MLR 3: **Students will locate needed information.**		
SUB-INDICATOR 3.1 (Webb Level: 1 Recall):		
SUB-INDICATOR 3.2 (Webb Level: 1 Recall):		
Knowledge (Factual): -Sources of vehicle service information.	**Understand (Conceptual):** -Importance of accurate specs needed for proper repair or maintenance services.	**Do (Application):** -Locate and use paper and electronic manuals -Locate and use Technical Service Bulletins (TSB) -Demonstrate awareness of special service messages, service campaigns/recalls, vehicle/service warranty applications, and service interval recommendations -Locate vehicle identification number (VIN) and production date code -Apply knowledge of VIN information -Demonstrate awareness of other vehicle information labels (such as tire, emissions, etc.)
Benchmarks: *Students will be assessed on their ability to:* • Retrieve accurate vehicle specifications and info.		

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Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): SL1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	**Sample Performance Task Aligned to the Academic Standard(s):** Students will discuss the different methodologies to gain vehicle information

INDICATOR #MLR 4: **Students will prepare vehicle for service.**		
SUB-INDICATOR 4.1 (Webb Level: 1 Recall): Prepare vehicle for service		
Knowledge (Factual): -Accurate repair order information -vehicle protection products	**Understand (Conceptual):** -Relationship of good customer service to shop profitability.	**Do (Application):** -Identify information needed and the service requested on a repair order -Identify purpose and demonstrate proper use of fender covers and mats -Demonstrate the use of the three C's (concern, cause, and correction) -Review vehicle service history -Complete work order with appropriate information
Benchmarks: *Students will be assessed on their ability to:* • Write a complete and accurate repair order.		

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): SL1 Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	**Sample Performance Task Aligned to the Academic Standard(s):** Students will role play the technician and customer to simulate proper customer service

INDICATOR #MLR 5: **Students will prepare vehicle for customer.**		
SUB-INDICATOR 5.1 (Webb Level: 2 Skill/Concept): Ensure vehicle is prepared to return to the customer per school/company policy		
Knowledge (Factual): -Returning vehicle to customer	**Understand (Conceptual):** -Customer service builds business.	**Do (Application):** -Inspect vehicle after repair and remove protective covers
Benchmarks: *Students will be assessed on their ability to:* • Properly complete vehicle for return to customer. (quality control check)		

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience	**Sample Performance Task Aligned to the Academic Standard(s):** Students will create a checklist of characteristics of quality customer service

INDICATOR #MLR 6: **Students will perform basic vehicle service.**		
SUB-INDICATOR 6.1 (Webb Level: 2 Skill/Concept): Perform basic vehicle service		
Knowledge (Factual): -Basic oil change/inspection service	**Understand (Conceptual):** -Importance of proper maintenance for extended engine life.	**Do (Application):** -Determine fluid type requirements and identify fluid

		-Check and adjust engine oil -Check and adjust engine coolant level -Check and adjust power steering fluid level -Check and adjust brake fluid level -Check and adjust windshield washer fluid level -Check and adjust differential /transfer case fluid level -Check and adjust transmission fluid level -Check and replace wiper blades -Inspect drive belts, tensioners, and pulleys; check pulley and belt alignment -Inspect and replace air filter -Check and adjust tire air pressure -Inspect exhaust system

Benchmarks:
Students will be assessed on their ability to:

- Properly perform basic engine service/inspection.
- Complete related paper work/forms.
- Maintain vehicle service history.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	**Sample Performance Task Aligned to the Academic Standard(s):** Students will discuss value of maintaining vehicle service history

INDICATOR #MLR 7: **Students will inspect and repair engine.**

SUB-INDICATOR 7.1 (Webb Level: 2 Skill/Concept): Test and perform actions necessary to repair engine

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Inner workings an internal combustion engine. -Perform engine diagnostics	-Relationship of accurate engine inspection and repair for safety and engine longevity.	-Demonstrate knowledge of internal combustion engine -Inspect engine assembly for fuel, oil coolant and other leaks; determine necessary action -Perform cooling system pressure tests; test coolant condition; inspect and test radiator, pressure cap, coolant recovery tank and hoses; determine necessary action -Test cooling system for the presence of combustion gases

		-Drain and recover coolant; flush and refill cooling system with recommended coolant; bleed air as required -Perform oil and filter change; reset oil life monitoring system where applicable

Benchmarks:
Students will be assessed on their ability to:

- Diagnose engine related concerns.
- Determine appropriate repairs needed.
- Perform needed repairs.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	Students will create a checklist that will help diagnose engine related concerns

INDICATOR #MLR 8: **Students will service an automatic transmission.**

SUB-INDICATOR 8.1 (Webb Level: 2 Skill/Concept): Service transmission system

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Automatic transmission operation	-Preventative maintenance extends life of transmission.	-Drain automatic transmission fluid -Visually inspect the amount of debris in oil pan -Remove filter and install new filter. -Install the proper fluid to the proper level

		-Perform transmission flush service

Benchmarks:
Students will be assessed on their ability to:

- Properly service automatic transmission.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	**Sample Performance Task Aligned to the Academic Standard(s):** Students will discuss how preventative maintenance extends life of transmission

INDICATOR #MLR 9: **Students will inspect, diagnose and repair manual drive train and axles.**

SUB-INDICATOR 9.1 (Webb Level: 2 Skill/Concept): Diagnose and repair manual drive train and axles

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Function of individual components in the drivetrain system. -Recognize and diagnose drivetrain issues	-Maintain drivetrain service to avoid component failures	-Diagnose fluid loss, level, and condition concerns -Drain and fill transmission/transaxle and final drive unit -Identify and inspect clutch pedal linkage, cables, automatic adjuster mechanisms, brackets, bushings, pivots, and springs -Identify and inspect hydraulic clutch slave and master cylinders, lines and hoses

		-Bleed clutch hydraulic system -Inspect constant velocity (CV) joint boots -Remove and replace rear wheel drive shaft

Benchmarks:
Students will be assessed on their ability to:

- Diagnose, maintain and repair drivetrain components.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	**Sample Performance Task Aligned to the Academic Standard(s):** Students will discuss key issues to help diagnose drive train performance

INDICATOR #MLR 10: **Students will repair suspension and steering.**		
SUB-INDICATOR 10.1 (Webb Level: 2 Skill/Concept): Diagnose suspension and steering; determine necessary action.		
SUB-INDICATOR 10.2 (Webb Level: 2 Skill/Concept): Inspect and repair tire and wheel assembly		
Knowledge (Factual): -The principles of steering geometry using caster, camber and toe -Service considerations of vehicles equipped with a TPMS -Suspension system operation	**Understand (Conceptual):** -Safety, drive-ability and ride quality concerns -Avoid causing damage during service process	**Do (Application):** -Flush, fill and bleed power steering system -Diagnose power steering fluid leakage -Lubricate suspension and steering systems -Inspect, remove and replace shock absorbers

		-Inspect and install stabilizer bar bushings, brackets, and links. -Inspect and install strut cartridge or assembly, coil spring, insulators (silencers), and upper strut mount -Perform pre-alignment inspection and measure vehicle ride height -Diagnose tire wear patterns -Diagnose wheel/tire vibration, shimmy, and noise -Identify vehicles equipped with a tire pressure monitoring system (TPMS) -Rotate tires according to manufacturer's recommendations. -Balance wheel and tire assembly -Dismount, inspect, and remount tire on wheel -Repair tire using internal patch -Reinstall wheel; torque lug nuts

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Benchmarks:
Students will be assessed on their ability to:

- Perform diagnose and repair steering and suspension.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	**Sample Performance Task Aligned to the Academic Standard(s):** Students will write a paragraph that explains how to avoid causing damage during service process

INDICATOR #MLR 11: **Students will inspect, diagnose and repair brake assembly.**		
SUB-INDICATOR 11.1 (Webb Level: 2 Skill/Concept): Diagnose and repair brake fluid system		
SUB-INDICATOR 11.2 (Webb Level: 2 Skill/Concept): Inspect and repair brake shoes and drum assemblies		
SUB-INDICATOR 11.3 (Webb Level: 2 Skill/Concept): Inspect and repair caliper assembly		
SUB-INDICATOR 11.4 (Webb Level: 2 Skill/Concept): Inspect and repair rotor assembly		
SUB-INDICATOR 11.5 (Webb Level: 1 Recall): Inspect and repair vacuum supply		
SUB-INDICATOR 11.6 (Webb Level: 2 Skill/Concept): Inspect and repair brake indicator light components		
Knowledge (Factual): -Use of vacuum pump tester -Brake warning light system wiring and circuitry -Hydraulic brake system -Brake friction components.	**Understand (Conceptual):** -Proper working systems for vehicle safety.	**Do (Application):** -Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and support -Select, handle, and fill brake fluids to proper level -Bleed brake system

		-Test brake fluid for contamination -Remove, clean, inspect and measure brake drums -Refinish brake drum; measure final drum diameter -Remove, clean, inspect brake shoes, springs, pins, clips, levers, adjuster/self-adjuster, other related brake hardware, and backing support plates; lubricate and reassemble -Inspect and install wheel cylinders -Pre-adjust brake shoes and parking brake; install brake drums or drum/hub assemblies and wheel bearings -Install wheel, torque lug nuts, and make final checks and adjustments -Remove caliper assembly; inspect for leaks and damage to caliper housing -Clean and inspect caliper mounting and slides/pins for wear, operation and damage

		-Remove, inspect and replace pads and retaining hardware; determine necessary action -Reassemble, lubricate, and reinstall caliper, pads and related hardware; seat pads and inspect for leaks -Clean, inspect and measure rotor thickness, lateral runout and thickness variation -Remove and reinstall rotor -Refinish rotor on vehicle; measure final rotor thickness -Refinish rotor off vehicle; measure final rotor thickness -Install wheel. Torque lug nuts -Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster -Inspect vacuum-type power booster unit for leaks; inspect the check valve for proper operation; verify proper booster function

		-Check parking brake cables and components for wear, binding and corrosion; clean, lubricate, adjust or replace as needed. -Check parking brake and indicator light system operation -Check operation of brake light system -Replace tapered roller wheel bearing and race -Clean, inspect, lubricate, install and adjust wheel bearing -Identify and inspect electronic brake control system components

Benchmarks:
Students will be assessed on their ability to:

- Perform diagnostics and repair on brake system.

Academic Connections

ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	Students will create a checklist that illustrates possible causes for wheel noise

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INDICATOR #MLR 12: **Students will inspect, test and repair electrical/electronic systems.**		
SUB-INDICATOR 12.1 (Webb Level: 1 Recall): Diagnose electrical circuit problems		
SUB-INDICATOR 12.2 (Webb Level: 2 Skill/Concept): Inspect and repair battery problems		
SUB-INDICATOR 12.3 (Webb Level: 2 Skill/Concept): Diagnose and repair starter		
SUB-INDICATOR 12.4 (Webb Level: 2 Skill/Concept): Diagnose and repair charging system		
Knowledge (Factual): -Electrical/electronic systems -Causes and effects of shorts, grounds, opens and resistance problems in electrical/electronic circuits -Wiring diagrams -The proper use of a digital multimeter (DMM)	**Understand (Conceptual):** -Electrical technology is heavily integrated into modern vehicles.	**Do (Application):** -Diagnose electrical/electronic integrity of series, parallel and series-parallel circuits using principles of electricity (Ohm's Law) -Check electrical circuits with a test light -Check electrical circuits using fused jumper wires -Measure key-off battery draw (parasitic draw) -Inspect and test fusible links, circuit breakers and fuses -Inspect and test switches, connectors, relays and wires of electrical/electronic circuits -Repair connectors and terminal ends -Perform solder repair of electrical wiring

		-Perform battery state-of-charge test -Perform battery capacity test; confirm proper battery capacity for vehicle application -Maintain or restore electronic memory functions -Inspect, clean, fill, and/or replace battery, battery cables, connectors, clamps and hold-downs -Perform battery charge -Start a vehicle using jumper cables and a battery or auxiliary power supply. -Perform starter current draw tests -Perform starter circuit voltage drop tests -Inspect and test starter relays and solenoids -Remove and replace starter -Perform charging system output test -Remove and replace generator (alternator)

		-Diagnose the cause of dim, or no light operation -Inspect, replace, and aim headlights and bulbs

Benchmarks:
Students will be assessed on their ability to:

- Perform diagnostics, maintenance and repair on electrical/electronic systems.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	Students will create an inspection checklist to perform electrical system repair
A-CED4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.	Students will create a mathematical model representing the electrical system

INDICATOR #MLR 13: **Students will inspect, diagnose and repair heating and air conditioning.**

SUB-INDICATOR 13.1 (Webb Level: 2 Skill/Concept): Identify and visually inspect A/C system components

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Air condition system (A/C) -Heating system	-Vehicle passenger comfort	-Locate refrigerant label and identify specified refrigerant type (e.g., R12, R-134a) -Conduct performance test of the heater/ventilation system

		-Inspect and replace cabin air filter

Benchmarks:
Students will be assessed on their ability to:

- Perform diagnostics and repair on heating and air conditioning system.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): W4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.	**Sample Performance Task Aligned to the Academic Standard(s):** Students will create a diagram that illustrates all AC system components

INDICATOR #MLR 14: **Students will inspect, diagnose and improve engine performance.**

SUB-INDICATOR 14.1 (Webb Level: 2 Skill/Concept): Perform the necessary tests and repairs to improve engine performance

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-proper engine function -diagnostics with scan tool	-To make vehicle run as designed.	-Perform engine cranking and running vacuum tests -Perform cylinder power balance test -Perform cylinder cranking compression test -Perform cylinder leakage test -Verify engine operating temperature

		-Retrieve and record stored diagnostic trouble codes, On-Board Diagnostics (OBD) monitor status and freeze frame data -Obtain and interpret scan tool data. -Perform fuel pressure test -Replace fuel filters. -Remove and replace secondary ignition components -Remove and replace thermostat and gasket/seal -Perform common fastener and thread repair, to include: removing broken bolt, restoring internal and external threads, and repairing internal threads with a threaded insert1

Benchmarks:

Students will be assessed on their ability to:

- Diagnose and make needed repairs to improve engine performance.

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard): SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	**Sample Performance Task Aligned to the Academic Standard(s):** Students will discuss the various factors that impact engine performance

INDICATOR #MLR 15: **Students explore career opportunities in the transportation, distribution and logistics career cluster and develop leadership skills.**		
SUB-INDICATOR 1.1 (Webb Level: 1 Recall): Research career opportunities in the transportation, distribution and logistics (TD&L) fields		
Knowledge (Factual): -Career options available	**Understand (Conceptual):** -Verify desire for an auto repair career.	**Do (Application):** -Utilizing career exploration software, research and write a report on career opportunities in the TD&L field -Utilizing career exploration software, research educational requirements for a chosen career path -Utilizing career exploration software, update the student's portfolio

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Benchmarks:
Students will be assessed on their ability to:

- Develop a portfolio on the chosen career

Academic Connections	
ELA Literacy and/or Math Standard (if applicable, Science and/or Social Studies Standard):	**Sample Performance Task Aligned to the Academic Standard(s):**
W7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.	Students will create a power point presentation comparing possible career options

Additional Resources
Please list any resources (e.g., websites, teaching guides, etc.) that would help teachers as they plan to teach these new standards.