south dakota DEPARTMENT OF EDUCATION
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CTE Standards Unpacking
Intro to Vehicle Systems & Maintenance

Course: Intro to Vehicle Systems & Maintenance
Course Description: Intro to Vehicle Systems & Maintenance is an introductory automobile course. Students will study the basic principles of electrical and mechanical systems used in motor vehicle technology while developing core hand skills. This course is designed to give learners an insight into careers in the automotive service and repair industry and encourages learners to undertake many maintenance and repair tasks.
Career Cluster: Transportation, Distribution & Logistics
Prerequisites: N/A
Program of Study Application: Intro to Vehicle Systems and Maintenance is a cluster course in the transportation, distribution and logistics cluster. Intro to Vehicle Systems and Maintenance will prepare a student to enter any of the pathways in the cluster.

<table>
<tr><td colspan="3">INDICATOR #IVSM 1: Students will demonstrate automotive technology safety practices, including Occupational Safety and Health Administration (OSHA) and Environmental Protection Agency (EPA) requirements, for an automotive repair facility.</td></tr>
<tr><td colspan="3">SUB-INDICATOR 1.1 (Webb Level: 2 Skill/Concept): Demonstrate automotive technician safety practices</td></tr>
<tr><td colspan="3">SUB-INDICATOR 1.2 (Webb Level: 2 Skill/Concept): Understand the way in which waste gasses, emissions, and other environmentally destructive substances are generated and their effects on the environment</td></tr>
<tr><td>Knowledge (Factual):
-General shop and safety procedures

- Emissions on various types of engines.

-Various types of fire extinguishers.</td><td>Understand (Conceptual):
-Importance of shop and person safety procedures.

-The effects of vehicle emissions on the eco-system

- Uses for the various types of fire extinguishers.</td><td>Do (Application):
-Use of protective clothing and safety equipment according to OSHA and EPA requirements.

-Summarize the proper use of safety data sheet (SDS)

- Demonstrate the proper use of hand and power tools

-Apply basic shop safety using OSHA standards</td></tr>
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		-Compare the emissions of hydro-fuel cell, electric, and gasoline powered vehicles -Locate and identify various types of fire extinguishers.

Benchmarks:
Students will be assessed on their ability to:

- Successfully pass shop safety, equipment and emissions exams.
- Maintain a portfolio of successfully completed safety and equipment exams.

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):**
SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	Students will discuss the various types of engines and the effect of emissions on the environment.

INDICATOR #IVSM 2: **Students explore career opportunities in the transportation, distribution and logistics career cluster and develop leadership skills.**

SUB-INDICATOR 2.1 (Webb Level: 2 Skill/Concept): Demonstrate independent and teamwork skills

SUB-INDICATOR 2.2 (Webb Level: 2 Skill/Concept): Explore career opportunities within the industry

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Career and Technical Student Organizations (CTSO's) -Independent and teamwork skills -Career opportunities	-Additional career information in CTSOs -Importance of teamwork -Multiple options in the industry -Importance of portfolios	-Research career and technical organizations. -Develop a teamwork project (change oil, tire rotation) -Utilize guidance software to research and report on career opportunities

-Portfolios guide learning		-Update student portfolios and personal learning plans

Benchmarks:
Students will be assessed on their ability to:

- Complete an artifact on a career opportunity.
- Demonstration of team work project.
- Maintain an accurate portfolio.

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):**
SL4. Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range or formal and informal tasks.	-Students will explain the procedures of their teamwork project.

INDICATOR #IVSM 3: **Students will demonstrate an understanding of the safe and appropriate use of tools, equipment and work processes.**
SUB-INDICATOR 3.1 (Webb Level: 2 Skill/Concept): Understand and use the appropriate tools and equipment
SUB-INDICATOR 3.2 (Webb Level: 2 Skill/Concept): Diagnose and analyze components and systems
SUB-INDICATOR 3.3 (Webb Level: 2 Skill/Concept): Select and demonstrate proper use of measuring devices and mathematical formulas
SUB-INDICATOR 3.4 (Webb Level: 2 Skill/Concept): Use and understand standard and metric units of measurements
SUB-INDICATOR 3.5 (Webb Level: 2 Skill/Concept): Use measurement devices to diagnose and repair vehicles and components following industry standards
SUB-INDICATOR 3.6 (Webb Level: 2 Skill/Concept): Demonstrate access and proper usage of Technical Service Bulletins (TSB) and service manuals

SUB-INDICATOR 3.7 (Webb Level: 3 Strategic Thinking): Comprehend the importance of calibration processes, systems, techniques using various measuring and testing devices		
Knowledge (Factual): -Tool care and maintenance. -Mathematical formulas in the automotive industry	**Understand (Conceptual):** -Specific function of tools. -Importance of proper maintenance and care of tools and equipment -Difference between and applications of standard and metric units. -Importance of information of the owner's manual.	**Do (Application):** -Demonstrate and identify tools and equipment - Use DMM (digital multi-meter) to measure electrical voltage, amps and resistance. -Demonstrate use of a load tester. -Measure caster, camber and toe -Measure brake rotor specifications. -Measure resistance in spark plug high-tension leads -Use scan tool to pull trouble codes -Calibrate of a dial indicator -Check the accuracy of an outside/inside micrometer -Calibrate an Ohm meter -Identify, apply, and calculate mathematical formulas -Convert standard units and metric units

		-Utilize service information to find vehicle specification

Benchmarks:
Students will be assessed on their ability to:

- *Utilize measuring tools to be able to record proper/accurate measurements*
- *Convert measurements through multiple formats..(ie. Standard to metric, decimals to fractions, liters to quarts)*

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):**
SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	Students will explain the importance of utilizing the owner's manual.
A-CED1. Create equations and inequalities in one variable and use them to solve problems.	Students will create a formula of calibration

INDICATOR #IVSM 4: **Students understand scientific principles in relation to chemical, mechanical, and physical functions of various power plants and vehicle systems.**

SUB-INDICATOR 4.1 (Webb Level: 2 Skill/Concept): Demonstrate knowledge of the operation of the internal combustion engine

SUB-INDICATOR 4.2 (Webb Level: 2 Skill/Concept): Demonstrate a basic understanding of the operating principles of heating and air conditioning systems

SUB-INDICATOR 4.3 (Webb Level: 2 Skill/Concept): Compare alternate fuel and power sources

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-The similarities and differences in a 2 and 4 stroke cycle -Hybrid, fuel cell and electric vehicles -Heating and air conditioning systems	-The air flow and refrigerant flow in heating and air conditioning systems -Environmental effects hybrid, fuel cell and electric vehicles	-Identify different types of gasoline and diesel engines and 2 & 4 stroke engines -Identify the components of heating and air conditioning systems

	-Potential hazards of hybrid vehicles	-Identify and research hybrid, fuel cell, and electric vehicles for a written report or presentation

Benchmarks:
Students will be assessed on their ability to:

- Accurately identify different engine types and fuel systems of vehicles.
- Identify heating and air conditioning system components and location.

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 powerpoint that compares different engine types and fuel types in vehicles
HS-PS1-4 Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.	Students will create a blog about the chemical reactions within various engine systems

INDICATOR #IVSM 5: **Students perform and document maintenance procedures according to manufacturers' specifications.**

SUB-INDICATOR 5.1 (Webb Level: 3 Strategic Thinking): Demonstrate the procedures and practices for manufacturer's repair and maintenance schedules

SUB-INDICATOR 5.2 (Webb Level: 3 Strategic Thinking): Demonstrate the use of service information to repair a vehicle

SUB-INDICATOR 5.3 (Webb Level: 3 Strategic Thinking): Demonstrate proper procedures for work order, customer information, and billing information completion

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Service information and requirements	-Vehicle repair and maintenance procedures.	-Change oil and filter according to manufacturer's specs

	-Importance of properly completed work order	-Check proper inflation and condition of vehicle tires -Check and refill critical fluids -Inspect belts and hoses -Use vehicle owner manual to find proper quantity and quality of oil to use to perform an engine oil and filter change -Demonstrate the proper use of a repair order that contains critical information -Complete work orders with customer, labor, and parts information

Benchmarks:
Students will be assessed on their ability to:

- Complete a work order
- Perform service on a vehicles.

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):**
SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on texts, and issues, building on others' ideas and expressing their own clearly and persuasively.	Students can role play a customer and technician discussing vehicle maintenance

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INDICATOR #IVSM 6: **Students will understand and apply appropriate business practices.**		
SUB-INDICATOR 6.1 (Webb Level: 3 Strategic Thinking): Demonstrate the importance of, and the procedures for, maintaining accurate records		
SUB-INDICATOR 6.2 (Webb Level: 3 Strategic Thinking): Understand the concept and application of ethical business practices		
SUB-INDICATOR 6.3 (Webb Level: 3 Strategic Thinking): Understand the concept and application of acceptable customer relations practices		
Knowledge (Factual): -Customer's opinions of the vehicle's problems	**Understand (Conceptual):** -Marking up parts for profit -Taxes and required taxable income -Billing of customers and collection of funds	**Do (Application):** -Recording the mileage of a vehicle on the work order for warranty purposes -Installation of quality new and/or used parts -Making only necessary repair -Return all settings of radio, seat and steering wheel positions to customer's settings
Benchmarks: *Students will be assessed on their ability to:* • To write an accurate repair order from the customers problem to final repair. • Be able to figure out profit on repair orders.		
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) with diverse partners on texts, and issues, building on others' ideas and expressing their own clearly and persuasively.	**Sample Performance Task Aligned to the Academic Standard(s):** Students will discuss the importance of the customers opinion to diagnose a problem	

A-CED1. Create equations and inequalities in one variable and use them to solve problems.	Students will create an equation for the estimated taxes

INDICATOR #IVSM 7: **Students will understand and apply appropriate vehicle service and repairs.**		
SUB-INDICATOR 7.1 (Webb Level: 2 Skill/Concept): Perform general engine diagnosis and repair in professional manner within National Automotive Technicians Education Foundation (NATEF) standards		
SUB-INDICATOR 7.2 (Webb Level: 2 Skill/Concept): Demonstrate ability to maintain and service lubrication and cooling systems		
SUB-INDICATOR 7.3 (Webb Level: 2 Skill/Concept): Understand the basic operation of computer controlled systems, and location and identification of related parts		
Knowledge (Factual): -Ignition systems -Lubrication system -Cooling systems -Computer system -Diagnostic procedures	**Understand (Conceptual):** -Diagnostic equipment and procedures -Component operation and location	**Do (Application):** -Perform engine compression test (dry/wet) -Analyze engine oil pressure -Remove and install an oil pressure sending unit -Inspect and test cooling system and pressure cap -Use a code reader and or scanner to diagnose computer system failure -Locate and test computer components -Clear trouble codes from computer with scanner -Set gap, and replace spark plugs and wires as needed

Benchmarks:
Students will be assessed on their ability to:

- Identify, test and repair/replace failed components.

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 write a newspaper article on the various benefits of using code readers
A-CED1. Create equations and inequalities in one variable and use them to solve problems.	Students will create an equation that models oil pressure

INDICATOR #IVSM 8: **Students understand the function, principles and operation of electrical systems using manufacturers' and industry standards**.		
SUB-INDICATOR 8.1 (Webb Level: 2 Skill/Concept): Demonstrate an understanding of how to diagnose and repair electrical systems		
SUB-INDICATOR 8.2 (Webb Level: 2 Skill/Concept): Diagnose and service batteries		
SUB-INDICATOR 8.3 (Webb Level: 2 Skill/Concept): Demonstrate knowledge needed to diagnose and repair starting and charging systems		
SUB-INDICATOR 8.4 (Webb Level: 2 Skill/Concept): Demonstrate ability to properly diagnose and repair lighting systems		
SUB-INDICATOR 8.5 (Webb Level: 2 Skill/Concept): Demonstrate ability to properly diagnose and repair heating and air conditioning systems		
Knowledge (Factual): -Charging, Battery and Starting systems -Coolant and A/C systems -Electrical/Lighting systems	**Understand (Conceptual):** -Diagnostics of electrical, charging, battery and starting systems -Diagnostics of heating and A/C system -Cooling system operation and diagnostics	**Do (Application):** -Clean battery terminals and electrical connections -Use DVOM (digital volt ohm meter) to check voltage drop at connections -Use DVOM to check resistance in electrical circuits

		-Check battery state-of-charge with hydrometer or DVOM -Check battery load capacity with load tester -Remove and replace battery -Check starting system draw with starting system tester -Check charging system output with charging system tester -Adjust headlights -Replace bulbs -Test electrical system circuits and components -Test strength and condition of coolant -Remove and replace coolant and flush if needed -Test output temperature of A/C system

Benchmarks:

Students will be assessed on their ability to:

- Make accurate diagnosis of system components to determine necessary repairs.
- Replace parts as needed to return system to proper operation.
- Determine best course of action for repair of system.

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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 to determine the best course of action for repair of AC system
A-CED1. Create equations and inequalities in one variable and use them to solve problems.	Students will create an equation that models the output of the AC system

INDICATOR #IVSM 9: **Students understand the function and principles of automotive brake, steering and suspension, automatic and manual transmission systems.**		
SUB-INDICATOR 9.1 (Webb Level: 2 Skill/Concept): Demonstrate how to diagnose and service hydraulic and friction systems		
SUB-INDICATOR 9.2 (Webb Level: 2 Skill/Concept): Demonstrate how to diagnose and service steering and suspension systems		
SUB-INDICATOR 9.3 (Webb Level: 2 Skill/Concept): Demonstrate how to diagnose and service automatic and manual transmissions		
Knowledge (Factual): -Brake hydraulic and friction systems -Steering and suspension systems -Automatic and manual transmission systems	**Understand (Conceptual):** -Operation and diagnosis of brake hydraulic and friction system components -Operation and diagnosis of steering and suspension system components -Operation and diagnostics of automatic and manual transmissions	**Do (Application):** -Check brake pad dimensions and conditions -Check condition of rotor and/or drum -Check for leaks, cracks or bulges in brake lines -Check emergency brake cable operation -Check for proper power steering fluid condition and level -Check condition of front and rear struts and/or shocks

		-Check automatic and manual transmission fluid levels -Replace automatic transmission fluid and filter

Benchmarks:
Students will be assessed on their ability to:

- Diagnose and perform repairs to disc and drum brake systems.
- Perform repairs and maintenance to steering and suspension systems.
- Perform maintenance to manual and automatic transmission.

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):**
SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led)	Students will discuss the differences between repairing an automatic transmission versus a manual transmission
A-CED1. Create equations and inequalities in one variable and use them to solve problems.	Students will create an equation modeling transmission fluid

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