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CTE Standards Unpacking
ATV/SEM (All-Terrain Vehicle/Small Engine Mechanics)

Course: ATV/SEM (All-Terrain Vehicle/Small Engine Mechanics)
Course Description: ATV/SEM is an introductory course on the small gas engine. The student will study the various small engine types, parts identification, and engine operation. Students will tear down a small gas engine. In order to have a properly running engine, students will inspect, reassemble and trouble shoot. Student evaluation is performance based.
Career Cluster: Transportation, Distribution & Logistics
Prerequisites: N/A
Program of Study Application: ATV/SEM is a cluster course within the Transportation, Distribution and Logistics career cluster.

INDICATOR #SEM 1: **Students will demonstrate shop and tool safety.**		
SUB-INDICATOR 1.1 (Webb Level: 1 Recall): Examine basic shop safety using Occupational Safety Health Administration (OSHA) standards		
SUB-INDICATOR 1.2 (Webb Level: 2 Skill/Concept): Demonstrate proper use of hand and power tools		
SUB-INDICATOR 1.3 (Webb Level: 2 Skill/Concept): Summarize the proper use of Safety Data Sheets (SDS)		
SUB-INDICATOR 1.4 (Webb Level: 3 Strategic Thinking): Create safety portfolio		
Knowledge (Factual): -OSHA 10 certification & requirements -First Aid -General tools (Name and function of tool being used, proper use of each tool, care and storage) -Never have an open flame near flammable liquids -Eye and hearing protection -Clothing and shoe protection -Spark test tools	**Understand (Conceptual):** -Follow proper refueling procedures -Fire extinguisher classifications and uses (A, B, C and D – and each class can put out a different type of fire) -Understand certain levels of safety portfolio.	**Do (Application):** -Locate Fire extinguisher/ Fire Blankets/Exits -Demonstrate proper start up and shutoff procedures (be aware of surroundings when pull-starting small gas engine (SGE)) -Review Torque wrench settings and usage -Spark test tools (Use appropriate spark tester to check spark)

-SDS(Safety Data Sheet) -Fire extinguisher classifications and uses		-Maintain records of written safety examinations -Maintain records of equipment examinations for which the student has passed an operational checkout -Review SDS

Benchmarks:
Students will be assessed on their ability to:

- OSHA 10 Certification
- Demonstrate the use of SDS
- General tool test
- Test engine for spark
- Creating and making of safety 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):**
W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience	Students will write an explanation of different types of fire extinguishers and explain proper use.
HS-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

INDICATOR #SEM 2: **Students will demonstrate independent and teamwork skills as well as explore career opportunities within the industry.**

SUB-INDICATOR 2.1 (Webb Level: 3 Strategic Thinking): Participate in leadership activities		
SUB-INDICATOR 2.2 (Webb Level: 4 Extended Thinking): Utilize guidance software to research and report on career opportunities		
SUB-INDICATOR 2.3 (Webb Level: 3 Strategic Thinking): Develop a teamwork project		
Knowledge (Factual): -Employability skills -Proper attire -Team building procedure	**Understand (Conceptual):** -Careers in ATV/SEM -Role as a team member	**Do (Application):** -CTSO's (Career and Technical Student Organizations) -Tear down/Rebuild procedures as a team -Research careers in ATV/SEM -SkillsUSA team building

Benchmarks:
Students will be assessed on their ability to:

- Follow Teardown and rebuild procedures
- Follow Torque specs for SGE
- Present on a career in ATV\SEM

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 present on a career within ATV/SEM

INDICATOR #SEM 4: **Students will apply communication, mathematics and science knowledge and skills to ATV/SEM.**

SUB-INDICATOR 4.1 (Webb Level: 3 Strategic Thinking): Examine how physics concepts apply to small engine technology		
SUB-INDICATOR 4.2 (Webb Level: 3 Strategic Thinking): Explore the application of fundamental laws of hydraulics		
SUB-INDICATOR 4.3 (Webb Level: 3 Strategic Thinking): Perform mathematical calculations and measurements commonly used in small engines		
SUB-INDICATOR 4.4 (Webb Level: 3 Strategic Thinking): Communicate findings as related to mathematics and science knowledge and skills to diagnosis problems in small engines		
Knowledge (Factual): -Math formulas -Fundamentals of Hydraulics -4-stroke and 2 stroke concepts -Compression ratio -Air fuel ratio -Stroke and bore	**Understand (Conceptual):** -The amount of work can be found with the equation w=f*d where w=work in lb/ft (ftlb), f=force in pounds, d=distance -Importance of using proper math formulas	**Do (Application):** -Student will determine horsepower of any small engine using HP=W/(T*33,000). HP = Horse power, W = Work, T = Time -Student will demonstrate the principle that fluids cannot be compressed by building a basic hydraulic cylinder/motor device on a test bench -Student will calculate displacement of any given engine based on the equation d=c*b2s c-constant 0.7584, b-bore, s-stroke, d-displacement -Students will complete a written report given the findings of any lab activity (e.g. low horse power due to poor air exchange).
Benchmarks: *Students will be assessed on their ability to:* • Lab activity reports • Calculate displacement • Calculate Horse Power		

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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):**
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 how they solved the problems using proper terminology for solving a problem.
A-REI3. Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.	Students will use linear algebraic techniques to solve physics problems with a missing variable.

INDICATOR #SEM 5: **Students will troubleshoot a small engine.**		
SUB-INDICATOR 5.1 (Webb Level: 4 Extended Thinking): Implement strategic diagnostic procedures		
SUB-INDICATOR 5.2 (Webb Level: 2 Skill/Concept): Conduct preventative maintenance on a small engine		
Knowledge (Factual): -Trouble shooting procedures -Engine parts -Maintenance procedures	**Understand (Conceptual):** -Methods of trouble shooting -Need to preform maintenance	**Do (Application):** -Apply small engine trouble shooting procedures. -Diagnose and determine needed repair on small engine components Determine wear on internal engine parts using specialized tools -Change oil and filter on small engine -Inspect and change air filter

		-Disassemble, clean, and inspect fuel pump -Disassemble, clean, and inspect carburetor

Benchmarks:
Students will be assessed on their ability to:

- Small gas engine trouble shooting and problem-solving techniques
- Perform maintenance or service on a SGE
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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):**
SL1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led).	Students will discuss repair and diagnostic procedures on small engine repair

INDICATOR #SEM 6: **Students will properly test, diagnose, service, and repair charging and electrical systems related to small engines.**

SUB-INDICATOR 6.1 (Webb Level: 3 Strategic Thinking): Illustrate the application of Ohm's law to charging and electrical systems related to small engines

SUB-INDICATOR 6.2 (Webb Level: 2 Skill/Concept): Interpret schematics, diagrams, and reference information used in small engine electrical systems

SUB-INDICATOR 6.3 (Webb Level: 3 Strategic Thinking): Use strategy-based diagnostics for determining the cause of a fault in an electrical circuit

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Appropriate tool usage -Read a multimeter -Schematic reading -Ohms Law -Basic 12 electrical systems	-Manufacture's guide -Battery voltage -Interpret a schematic -Apply Ohms law -Electrical circuits	-Complete the start amp draw test on a small engine with an electric start system. -Troubleshoot the charging circuit using a manufacturer's guide Read a multimeter -Test, diagnose, and service batteries and charging systems

		-Test, diagnose, and service light systems -Demonstrate the use of equipment and tools for electrical testing and diagnosis

Benchmarks:
Students will be assessed on their ability to:

- Complete the start amp draw test on a small engine with an electric start system. Compute amperage use of any circuit by using the equation amps=volts/ohm
- Read a multimeter
- Troubleshoot and repair starting circuit

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 troubleshooting small engines circuits
A-CED4. Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations. For example, rearrange Ohm's law V = IR to highlight resistance R.	Students will calculate resistance of circuits

INDICATOR #SEM 7: **Students will properly test, diagnose, service and repair fuel delivery systems as related to small engine technology.**

SUB-INDICATOR 7.1 (Webb Level: 3 Strategic Thinking): Analyze the functions and operations of a fuel system related to small engine technology

SUB-INDICATOR 7.2 (Webb Level: 3 Strategic Thinking): Diagnose fuel system problem

SUB-INDICATOR 7.3 (Webb Level: 3 Strategic Thinking): Perform fuel system service

Knowledge (Factual):	**Understand (Conceptual):**	**Do (Application):**
-Fuel System diagnostics	-Low and high idle circuits	

-Carburetor settings -Idle circuits -Air filter types	-Carburetor settings -Operations of a fuel system -Different air filter systems	-Complete fuel pressure test of system utilizing a fuel pump. -Set carburetor float height. -Adjust both low and high idle circuits on carburetor engines -Test and determine needed repair on fuel system -Remove and replace the fuel tank, fuel lines and fuel filter system -Service oil-bath or foam type air cleaner -Reassemble and adjust a carburetor

Benchmarks:
Students will be assessed on their ability to:

- Complete fuel injector function test on fuel injected engines.
- Set carburetor
- Inspect and determine needed repair on air cleaner system
- Reassemble and install fuel pump
- Preform engine run test with reassembled carburetor

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	Students will create a written explanation needed repair on fuel system

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 will role play customer and technician to discuss vehicle repair
HS-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 determine the scientific properties that are carried out in in carburetors.

INDICATOR #SEM 8: **Students will properly test, diagnose, service and repair emission systems related to small engine technology.**		
SUB-INDICATOR 8.1 (Webb Level: 4 Extended Thinking): Analyze the function and operation of emission systems related to small engines		
SUB-INDICATOR 8.2 (Webb Level: 4 Extended Thinking): Diagnose emission systems relating to small engine technology		
SUB-INDICATOR 8.3 (Webb Level: 3 Strategic Thinking): Perform emission system service on small engine		
Knowledge (Factual): -EPA emissions standards -electrical/electronic testing of manifold absolute pressure -Exhaust gas analyzer	**Understand (Conceptual):** -EPA emissions standards and requirements -Proper usage of emission tools	**Do (Application):** **-**Research EPA emissions standards on how laws affect the small engine service industry. -Use an exhaust gas analyzer to determine the amount of HC and NOx emissions contained in the exhaust from a small engine and determine repair strategies. -Complete electrical/electronic testing of manifold absolute pressure (MAP)

		sensor, O_2 (Oxygen) or throttle position sensor and determine whether repair or replacement of parts is needed. -Replace a MAP sensor. -Replace a fuel pressure sensor.

Benchmarks:
Students will be assessed on their ability to:

- Demonstrate or observe a fuel map in electronic format
- Write a report on how laws affect the small engine service industry.
- Explain the process of replacing a fuel presser sensor.

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 write a report on EPA standards
HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium	Students will look at various fuel maps and modify systems to make more efficient

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