

# Hybrids & Alternative Fuel Vehicles 4/E

## Chapter 5 Alternative Fuels

### Opening Your Class


KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of <a href="#">Hybrid and Alternative Fueled Vehicles</a> . It correlates material to task lists specified by ASE and NATEF.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge to figure why the engine does not work correctly and how this saves diagnosis time, which translates into more money.
State the learning objectives for the chapter or course you are about to cover and explain this is what they should be able to do as a result of attending session or class.	Explain the chapter learning objectives to the students. <ol style="list-style-type: none"><li>1. Describe how oxygenated fuels help reduce exhaust emissions.</li><li>2. List the types of oxygenated fuels.</li><li>3. Discuss how ethanol is made using grains or cellulose.</li><li>4. Discuss how the level of alcohol in the fuel is detected.</li><li>5. Explain phase separation.</li><li>6. Discuss safety precautions when working with methanol.</li></ol>
Establish the Mood or Climate	Provide a <i>WELCOME</i> , Avoid put downs and bad jokes.
Complete Essentials	Restrooms, breaks, registration, tests, etc.
Clarify and Establish Knowledge Base	Do a round robin of the class by going around the room and having each student give their backgrounds, years of experience, family, hobbies, career goals, or anything they want to share.









**NOTE: This lesson plan is based on Hybrids 4<sup>th</sup> Edition**











**Chapter Images found on Jim's web site @**







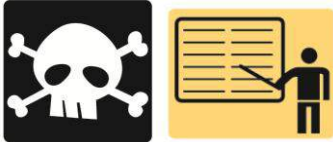


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**LINK CHP 5: [Chapter Images](#)**

ICONS	Ch05 Alternative Fuels
	<p><b>1. SLIDE 1 ALTERNATIVE FUELS</b></p> <p>Check for <b>ADDITIONAL VIDEOS &amp; ANIMATIONS</b>  @ <a href="http://www.jameshalderman.com/">http://www.jameshalderman.com/</a>  <b>WEB SITE IS CONSTANTLY UPDATED</b></p> <p>At the beginning of this class, you can download the crossword puzzle &amp; Word Search from the links below to familiarize your class with the terms in this chapter &amp; then discuss them</p> <p>Crossword Puzzle (<a href="#">Microsoft Word</a>) (PDF)  Word Search Puzzle (<a href="#">Microsoft Word</a>) (PDF)</p> <p><b>DISCUSS FREQUENTLY ASKED QUESTION</b></p> <p><b>2. SLIDES 2 EXPLAIN</b> Figure 5-1 ethanol molecule showing 2 carbon atoms, 6 hydrogen atoms, &amp; 1 O<sub>2</sub> atom</p> <p><b>DISCUSS FREQUENTLY ASKED QUESTION &amp; NOTE</b></p> <p><b><u>DISCUSSION:</u></b> DISCUSS ETHANOL AND HOW IT IS PRODUCED. SINCE ETHANOL PRODUCED FOR FUEL IS THE SAME AS THAT FOUND IN ALCOHOLIC DRINKS, CAN DRINK MANUFACTURERS PRODUCE FUEL FOR VEHICLES?</p> <p><b><u>SAFETY</u></b> REVIEW THE MEANING OF <b><u>DENATURED</u></b>. REMIND THE STUDENTS THAT WHEN FUEL BECOMES DENATURED, IT IS UNFIT FOR HUMAN CONSUMPTION.</p>

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       	<p><b>DISCUSSION: HAVE THE STUDENTS TALK ABOUT CELLULOSE BIOMASS? HOW ARE THE GREENHOUSE EFFECTS OF COMBUSTION OF BIOMASS OFFSET?</b></p> <p>3. <b>SLIDE 3 EXPLAIN</b> Figure 5-2 container with gasoline containing alcohol. Notice the separation line where the alcohol–water mixture separated from the gasoline and sank to the bottom</p> <p>4. <b>SLIDE 4 EXPLAIN</b> Figure 5-3 E10 is 10% ethanol and 90% gasoline</p> <p><b>DISCUSS FREQUENTLY ASKED QUESTION &amp; NOTE</b></p> <p><b>DEMONSTRATION: PLACE SOME GAS AND WATER IN A CLEAR CONTAINER FOR VIEWING. HAVE STUDENTS TALK ABOUT PHASE SEPARATION. DISCUSS WHAT HAPPENS WHEN AN ENGINE COMBUSTS A LITTLE WATER. WHAT WILL HAPPEN TO CYLINDER TEMPERATURE IF THIS HAPPENS?</b></p> <p>5. <b>SLIDE 5 EXPLAIN</b> Figure 5-4 In-line blending is the most accurate method for blending ethanol with gasoline because computers are used to calculate the correct ratio.</p> <p>6. <b>SLIDE 6 EXPLAIN</b> Figure 5-5 Sequential blending uses a computer to calculate correct ratio as well as the prescribed order in which the products are loaded.</p> <p>7. <b>SLIDE 7 EXPLAIN</b> Figure 5-6 Splash blending occurs when ethanol is added to a tanker with gasoline and is mixed as truck travels to retail outlet.</p> <p><b><u>Fuel Blending In-Line (View) (Download)</u></b>  <b><u>Fuel Blending Sequential (View) (Download)</u></b>  <b><u>Fuel Blending Splash (View) (Download)</u></b>  <b><u>Fuel Mileage, Gas (View) (Download)</u></b>  <b><u>Fuel Mileage, Hybrid (View) (Download)</u></b></p> <p>8. <b>SLIDE 8 EXPLAIN</b> Figure 5-7 E85 contains 85% ethanol and 15% gasoline and can be used only in vehicles specifically designed to use it.</p> <p><b>DISCUSSION: HAVE STUDENTS TALK ABOUT <u>E85</u> AND ITS EFFECTS ON FUEL ECONOMY. IS IT WORTH USING <u>E85</u> SINCE YOU HAVE TO PURCHASE MORE <u>E85</u> THAN REGULAR GAS FOR</b></p>

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	<p><b>THE SAME MILEAGE? WHAT IS PRICE DIFFERENCE BETWEEN REGULAR GAS &amp; E85? <u>FIGURE 5-2 DEMONSTRATION: SHOW STUDENTS LOCATION OF VARIABLE FUEL SENSOR. REVIEW ITS FUNCTION WITH THE STUDENTS: FIGURES 5-8 &amp; 9</u></b></p>
	<p>9. SLIDE 9 EXPLAIN Figure 5-8 location of sensor can vary, depending on make &amp; model of vehicle, but it is always in fuel line between tank &amp; injectors.</p>
	<p>10. SLIDE 10 EXPLAIN Figure 5-9 cutaway view of a typical variable fuel sensor.</p>
	<p><b><u>DISCUSSION: DISCUSS FUEL COMPENSATION. COMPARE USE OF FUEL COMPENSATION SENSOR AND OXYGEN SENSOR FOR A FLEX-FUEL SYSTEM. WHY SHOULD A TECHNICIAN AVOID RESETTNG FUEL COMPENSATION?</u></b></p>
	<p>DISCUSS FREQUENTLY ASKED QUESTION</p>
	
	<p><b><u>DISCUSSION: HAVE THE STUDENTS DISCUSS E85 FUEL SYSTEM REQUIREMENTS. WHAT ADDITIONAL HARDWARE IS ON E85 VEHICLES? FIGURE 5-5</u></b></p>
	<p><b><u>DISCUSSION: HAVE THE STUDENTS TALK ABOUT ENHANCED FUEL SYSTEM COMPONENTS &amp; MATERIALS USED FOR FLEX-FUEL VEHICLES. CAN ETHANOL DAMAGE COMMON FUEL PUMPS? WHAT WILL HAPPEN TO O-RINGS THAT ARE NOT ALCOHOL-RESISTANT?</u></b></p>
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	<p><b><u>DEMONSTRATION: USE A FLEX-FUEL VEHICLE TO SHOW STUDENTS IDENTIFIERS THAT PLACE IT IN E85 CLASS. TALK ABOUT EMISSIONS PRODUCED BY ETHANOL FUELED VEHICLES.</u></b></p>
	<p>11. SLIDE 11 EXPLAIN Figure 5-10 flex-fuel vehicle often has yellow gas cap, which is labeled E85/gasoline.</p>
	<p>EXPLAIN TECH TIP</p>

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	<p><b>HANDS-ON TASK: HAVE STUDENTS LOCATE <u>VECI</u> ON <u>FLEX-FUEL VEHICLES</u> YOU HAVE IN YOUR SHOP. HAVE STUDENTS SHARE LOCATIONS &amp; INFORMATION FOUND: <u>FIGURE 5-6</u>.</b></p>
	<p><b>HANDS-ON TASK: HAVE STUDENTS DIAGNOSE A VEHICLE WITH AN O<sub>2</sub> CODE PRESENT. HELP THEM USE <u>SCAN TOOL, DMM, &amp; 5-GAS ANALYZER</u>, AS NEEDED, FOR THEIR DIAGNOSES.</b></p>
	<p>12. <b>SLIDE 12 EXPLAIN</b> Figure 5-11 letters “FFV” included on the vehicle emission control information (VECI) sticker located under the hood indicates that the vehicle is designed to operate using E85, E10, E15, or gasoline</p>
	<p>13. <b>SLIDE 13 EXPLAIN</b> Figure 5-12 The molecular structure of methanol showing the one carbon atom, four hydrogen atoms, and one oxygen atom.</p>
	<p>14. <b>SLIDE 14 EXPLAIN</b> Figure 5-13 Sign on methanol pump shows that methyl alcohol is a poison and can cause skin irritation and other personal injury. Methanol is used in industry as well as being a fuel</p>
	<p><b>DISCUSS FREQUENTLY ASKED QUESTION</b></p>
	<p><b>EXPLAIN WARNING</b></p>
	<p><b><u>SAFETY</u> REVIEW WITH STUDENTS <u>PPE</u> THAT SHOULD BE USED WHEN HANDLING <u>METHANOL</u>. TALK ABOUT VENTILATION PROCEDURES WHEN WORKING WITH METHANOL VEHICLES, INCLUDING WHERE EXHAUST FANS SHOULD BE PLACED, OPENING BAY DOORS, MONITORING RUNNING VEHICLES IN SHOP, ETC. <u>FIGURE 5-9</u></b></p>
	<p><b><u>DISCUSSION:</u> HAVE THE STUDENTS TALK ABOUT <u>METHANOL</u> AND ITS PRODUCTION. WHAT IS BIGGEST SOURCE OF METHANOL IN UNITED STATES? WHAT IS <u>M85</u>?</b></p>

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  	<p><b><u>SAFETY</u> WHEN WORKING ON FUEL SYSTEMS, EQUIPMENT THAT CAN CREATE A SPARK/FLAME SHOULD BE REMOVED FROM AREA. REVIEW SHOP AREA &amp; ADDRESS WHICH ITEMS SHOULD BE REMOVED FOR WORKING ON FUEL SYSTEMS.</b></p> <p>15. SLIDE 15 EXPLAIN Figure 5–14 Checking gasoline for alcohol involves using a graduated cylinder and adding water to check if the alcohol absorbs the water.</p> <p>16. SLIDES 16-21 SLIDE SHOW TESTING ALCOHOL CONTENT IN GASOLINE</p>