

Hybrids & Alternative Fuel Vehicles 4/E

Chapter 4 Gasoline









Opening Your Class











KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of Hybrid and Alternative Fueled Vehicles . 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 this session or class.	Explain the chapter learning objectives to the students. <ol style="list-style-type: none">1. Describe how the proper grade of gasoline affects engine performance.2. List gasoline purchasing hints.3. Discuss how volatility affects driveability.4. Explain how oxygenated fuels can reduce CO exhaust emissions.5. Discuss safety precautions when working with gasoline.
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 4th Edition Chapter Images found on Jim's web site @










www.jameshalderman.com








LINK CHP 3: [Chapter Images](#)







ICONS	Ch04 Gasoline
	<p>1. SLIDE 1 Chapter 4 GASOLINE</p>
	<p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS CONSTANTLY UPDATED</p> <p><u>DISCUSSION:</u> TALK ABOUT CHEMICAL COMPOSITION OF <u>GASOLINE</u>. HOW MANY CARBON ATOMS DO HYDROCARBONS IN GASOLINE HAVE?</p>
 <p>QUESTION</p>	<p>At the beginning of this class, you can download the crossword puzzle & Word Search from the links below to familiarize your class with the terms in this chapter & then discuss them</p>
	<p><u>DISCUSSION:</u> TALK ABOUT DANGERS OF <u>HYDROCARBONS</u>. IS A HYDROCARBON HARMFUL AS A LIQUID? IS IT HARMFUL AS A GAS? WHAT SAFETY PRECAUTIONS SHOULD BE TAKEN WHEN HANDLING HYDROCARBONS?</p>
 <p>QUESTION</p>	<p>2. SLIDE 2 EXPLAIN Figure 4-1 crude oil refining process showing most of the major steps and processes</p>
	<p>Having different grades of gasoline, different blends, and varying freshness on hand as you discuss gasoline will offer students a variety of fuels to observe & test.</p>
	<p><u>HANDS-ON TASK:</u> HAVE THE STUDENTS COMPLETE AN <u>MSDS</u> REVIEW OF HYDROCARBONS TO DETERMINE WHETHER THEY UNDERSTAND HAZARDS OF HYDROCARBONS</p>
 <p>QUESTION</p>	<p><u>DISCUSSION:</u> HAVE THE STUDENTS TALK ABOUT <u>DISTILLATION</u> PROCESS. IN ADDITION TO FUEL, WHAT OTHER PRODUCTS ARE PRODUCED THROUGH DISTILLATION PROCESS?</p>

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  QUESTION 	<p><u>DEMONSTRATION:</u> LOCATE A VIDEO THAT DEMONSTRATES DISTILLATION PROCESS. HAVE STUDENTS WATCH IT & DISCUSS PROCESS. NATIONAL GEOGRAPHIC CHANNEL OR DISCOVERY CHANNEL ARE POSSIBLE VIDEO SOURCES. <u>LRC</u> MAY HAVE THIS VIDEO</p> <p><u>DISCUSSION:</u> HAVE THE STUDENTS DISCUSS CRACKING PROCESS. WHAT IS DIFFERENCE BETWEEN THERMAL CRACKING, CATALYTIC CRACKING, & HYDROCRACKING? <u>FIGURE 66-1</u></p> <p>3. SLIDE 3 EXPLAIN Figure 4-2 A gasoline testing kit, including an insulated container where water at 100° F is used to heat a container holding a small sample of gasoline. The reading on the pressure gauge is the Reid vapor pressure (RVP)</p>
  QUESTION     	<p><u>DEMONSTRATION:</u> SHOW THE STUDENTS HOW TO TEST GASOLINE, EMPHASIZING RVP READING AS A CLASSIFICATION FOR USAGE. <u>FIGURE 66-2</u></p> <p><u>DISCUSSION:</u> HAVE STUDENTS DISCUSS COLD START PROBLEMS THAT ARE RELATED TO FUEL ISSUES. WHY IS IT IMPORTANT FOR FUEL TO HAVE A SPECIFIC <u>RVP</u> READING?</p> <p>4. SLIDE 4 EXPLAIN Figure 4-3 A typical distillation curve. Heavier molecules evaporate at higher temperatures and contain more heat energy for power, whereas lighter molecules evaporate easier for starting.</p> <p>DISCUSS FREQUENTLY ASKED QUESTION ICON</p> <p>5. SLIDE 5 EXPLAIN Figure 4-4 An engine will not run if the air-fuel mixture is either too rich or too lean.</p> <p>6. SLIDE 6 EXPLAIN Figure 4-5 With a three-way catalytic converter, emission control is most efficient with an air-fuel ratio between 14.65 to 1 and 14.75 to 1.</p> <p><u>HANDS ON-TASK:</u> CHECK FUEL RVP BASED ON DEMO</p>

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	<p>DISCUSSION: HAVE THE STUDENTS TALK ABOUT HOW AIR-FUEL RATIOS ARE STATED. WHY IS THE RATIO USUALLY MEASURED BY WEIGHT AND NOT VOLUME?</p>
	<p>DEMONSTRATION: SHOW HOW FUEL INJECTOR SPRAYS FUEL INTO COMBUSTION CHAMBER BY CREATING AN EXTERNAL FUEL SYSTEM IN WHICH STUDENTS CAN VIEW AN INJECTOR SPRAYING FUEL INTO VISIBLE CONTAINER. FOR SAFETY REASONS, PERFORM THIS DEMONSTRATION WITH WATER INSTEAD OF FUEL, KEEPING IN MIND THAT INJECTORS AND PUMP SUSTAIN DAMAGE FROM WATER AFTER LONG-TERM USE.</p>
	<p>DISCUSSION: HAVE THE STUDENTS DISCUSS AIR-FUEL RATIOS. WHAT MAKES AN AIR-FUEL MIXTURE TOO RICH OR TOO LEAN?</p>
	<p>DISCUSSION: HAVE THE STUDENTS TALK ABOUT THE GASOLINE COMBUSTION PROCESS. WILL A CONTAMINATED ATMOSPHERE HAVE AN EFFECT ON COMBUSTION PROCESS? FIGURES 4-3 & 4</p>
	<p>DISCUSSION: HAVE THE STUDENTS REFER TO FIGURE 4-5 AND DISCUSS WHAT HAPPENS TO NO_x, CO, AND HC IN THREE-WAY CATALYTIC CONVERTER. WHY DOES STOICHIOMETRIC RATIO WORK BEST TO CONTROL THESE MIXTURES? ANS: STOICHIOMETRIC IS CONCERNED WITH, INVOLVING, OR HAVING THE EXACT PROPORTIONS FOR A PARTICULAR CHEMICAL REACTION.</p>
	<ol style="list-style-type: none"> 7. SLIDE 7 EXPLAIN Figure 4-6 Normal combustion is a smooth, controlled burning of the air-fuel mixture. 8. SLIDE 8 EXPLAIN Figure 4-7 Detonation is a secondary ignition of the air-fuel mixture. It is also called spark knock or pinging.
	<p>DEMONSTRATION: HAVE STUDENTS LISTEN TO A VEHICLE MAKING KNOCKING SOUND DUE TO DETONATION. ASK THEM TO DESCRIBE WHAT THIS SOUNDS LIKE TO THEM. THIS CAN BE DONE ON AN OLDER VEHICLE BY ADVANCING TIMING OR</p>

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	<p>DISCONNECTING EGR: <u>FIGURE 4-7</u> <u>HANDS-ON TASK:</u> HAVE STUDENTS USE A <u>5-GAS ANALYZER ON A VEHICLE.</u> ASK THEM TO RECORD READINGS AND INTERPRET THEIR FINDINGS.</p>
	<p>9. SLIDE 9 EXPLAIN Figure 4-8 A pump showing regular with a pump octane of 87, plus rated at 89, and premium rated at 93. These ratings can vary with brand as well as in different parts of the country.</p>
	<p><u>DISCUSSION:</u> TALK ABOUT GASOLINE GRADES. IS IT ALWAYS BETTER TO USE PREMIUM GAS? POINT OUT PROBLEMS OF HARD START & ROUGH IDLE USING <u>PREMIUM-GRADE GASOLINE</u> DURING COLD WEATHER CONDITIONS.</p>
	<p><u>DISCUSSION:</u> TALK ABOUT INJECTOR FLOW RATE. WHAT IS THE RELATION OF INJECTOR FLOW RATE TO HORSEPOWER?</p>
	<p><u>DISCUSSION:</u> TALK ABOUT OCTANE RATING. HOW IS ISOCTANE USED IN OCTANE RATING? WHAT ARE METHODS USED TO RATE GASOLINE FOR ANTIKNOCK PROPERTIES? <u>FIGURE 4-8</u></p>
	<p><u>HANDS-ON TASK:</u> LOCATE A <u>KNOCK SENSOR</u> ON A VEHICLE. ASK THEM TO REVIEW OEM INFORMATION ABOUT SENSOR. HAVE STUDENTS USE A <u>SCAN TOOL</u> TO COMPARE IT TO LIVE DATA FROM SENSOR. IS KNOCK SENSOR ACCURATE?</p>
	<p>DISCUSS FREQUENTLY ASKED QUESTION</p>
	<p>EXPLAIN TECH TIP</p>
	<p><u>DISCUSSION:</u> HAVE STUDENTS DISCUSS <u>HIGH-ALTITUDE</u> OCTANE REQUIREMENTS. WHAT HAPPENS TO AIR WHEN ATMOSPHERIC PRESSURE DROPS? HOW DOES LOWERED ATMOSPHERIC PRESSURE AFFECT OCTANE RATING?</p>

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      	<p>10. SLIDE 10 EXPLAIN Figure 4-9 The posted octane rating in most high-altitude areas shows regular at 85 instead of the usual 87.</p> <p>DISCUSS FREQUENTLY ASKED QUESTION</p> <p><u>DISCUSSION:</u> HAVE STUDENTS DISCUSS GASOLINE ADDITIVES. WHAT PROBLEMS CAN BE CAUSED BY ADDITIVES?</p> <p>11. SLIDE 11 EXPLAIN Figure 4-10 gas cap on a Ford vehicle notes that BP fuel is recommended.</p> <p>12. SLIDE 12 EXPLAIN Figure 4-11 Many gasoline service stations have signs posted warning customers to place plastic fuel containers on the ground while filling. If placed in a trunk or pickup truck bed equipped with a plastic liner, static electricity could build up during fueling and discharge from the container to the metal nozzle, creating a spark and possible explosion. Some service stations have warning signs not to use cell phones while fueling to help avoid the possibility of an accidental spark creating a fire hazard.</p> <p><u>DEMONSTRATION:</u> 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?</p> <p><u>DISCUSSION:</u> HAVE STUDENTS TALK ABOUT REFORMULATED GASOLINE. WILL REFORMULATED GAS WORK WELL IN COLD WEATHER CONDITIONS? HAVE STUDENTS DISCUSS CHANGES MADE TO REFORMULATE GASOLINE. WHAT HAS BEEN RESULT IN AREAS WHERE REFORMULATED GAS IS BEING USED?</p> <p>DISCUSS FREQUENTLY ASKED QUESTION</p>

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     	<p> <u>Fuel Blending In-Line</u> <u>Fuel Blending Sequential</u> <u>Fuel Blending Splash</u> </p> <p>EXPLAIN TECH TIP</p> <p> <u>DISCUSSION:</u> HAVE STUDENTS DISCUSS KEEPING FUEL LEVEL ABOVE ¼ TANK. WHY SHOULD FUEL LEVEL BE KEPT ABOVE THAT LEVEL? </p> <p> WHEN A RICH MIXTURE IS DETECTED & FUEL GAUGE READS FULL, REMIND THE STUDENTS TO CHECK CHARCOAL CANISTER OUTLET TO THE ENGINE. VERIFY TO SEE WHETHER LIQUID GAS IS BEING SUCKED INTO THE ENGINE. TEMPORARY BLOCKAGE OF LINE AND REPEATED CHECKING OF O₂ SENSOR READINGS COULD VERIFY CONDITION. </p> <p> <u>SAFETY</u> DISCUSS IMPORTANCE OF HAVING A FIRE EXTINGUISHER AVAILABLE WHEN WORKING WITH FUEL, & WEARING PPE INCLUDING SAFETY GLASSES, RESPIRATOR, AND GLOVES. </p> <p> <u>DISCUSSION:</u> HAVE THE STUDENTS TALK ABOUT USING A FUEL COMPOSITION TESTER TO TEST FOR ALCOHOL CONTENT IN GASOLINE. WHAT IS THE FIRST STEP TO USING TESTER? </p>