

Introduction to Automotive Service

Chapter 28 GASOLINE & ALTERNATIVE FUELS

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class serves as an introduction to the world of automotive service. 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.	<p>Explain learning objectives to students.</p> <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. 6. Discuss the advantages and disadvantages of Alternative Fuels.
Establish the Mood or Climate	Provide a WELCOME , 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.

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	<p>1. SLIDE 1 Ch28 GASOLINE & ALTERNATIVE FUELS</p>
	<p>Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE IS UPDATED REGULARLY</p>
	<p><u>Fuel and Air (133 Links)</u> AVAILABLE VIDEOS</p>
	<p><u>DISCUSSION:</u> Have the students talk about chemical composition of gasoline. How many carbon atoms do the hydrocarbons in gasoline have?</p>
	<p><u>DISCUSSION:</u> Have the students talk about the dangers of hydrocarbons. Is a hydrocarbon harmful as a liquid? Is it harmful as a gas? What safety precautions should be taken when handling hydrocarbons?</p>
	<p>2. SLIDE 2 EXPLAIN Gasoline 3. SLIDE 3 EXPLAIN FIGURE 28-1 crude oil refining process showing most of the major steps and processes. 4. SLIDE 4 EXPLAIN FIGURE 28-2 A pig is a plug-like device that is placed in a pipeline to separate two types or grades of fuel</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 MSDS review of hydrocarbons to determine whether they understand hazards of hydrocarbons</p>
	<p><u>DISCUSSION:</u> Have the students talk about Distillation process. In addition to fuel, what other products are produced through distillation</p>

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	<p>process?</p> <p>DEMONSTRATION: Locate a <u>video</u> that demonstrates distillation process. Have students watch it & discuss process. National Geographic Channel or Discovery Channel are possible video sources.</p>
	<p>DISCUSSION: Have the students discuss cracking process. What is difference between thermal cracking, catalytic cracking, & hydrocracking?</p>
	<p>5. SLIDE 5 EXPLAIN Gasoline</p> <p>6. SLIDE 6 EXPLAIN FIGURE 28-3 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>DISCUSSION: Have the students talk about grades of gasoline. Is it always better to use premium gas? Point out the problems of hard start and rough idle using <u>premium-grade gasoline</u> during cold weather conditions.</p>
	<p>DISCUSSION: Have the students talk about injector flow rate. What is the relation of injector flow rate to horsepower?</p>
	<p>DISCUSSION: Have the students talk about octane rating. How is isooctane used in octane rating? What are the methods used to rate gasoline for antiknock properties?</p>
	<p>HANDS-ON TASK: Have the students 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>DISCUSSION: Have students discuss gasoline additives. What problems can be caused by additives?</p>

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DEMO



DEMO



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?

7. **SLIDE 7 EXPLAIN** Figure 28-4 This refueling pump indicates that the gasoline is blended with 10% ethanol (ethyl alcohol) and can be used in any gasoline vehicle. E85 contains 85% ethanol and can be used only in vehicles specifically designed to use it.
8. **SLIDE 8 EXPLAIN** Gasoline Recommendations

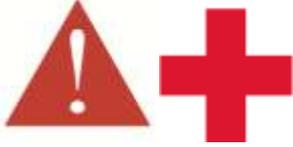
DISCUSSION: Have students talk about reformulated gasoline. Will reformulated gas work well in cold weather conditions? Have students discuss changes made to reformulate gasoline. What has been result in areas where reformulated gas is being used?

9. **SLIDE 9 EXPLAIN FIGURE 28-5** 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.

DEMONSTRATION: Demonstrate a sniff test on stale gasoline. Talk about what gasoline stabilizer is, when to use it, and where to find it.

DISCUSSION: Have students discuss keeping the fuel level above ¼ tank. Why should fuel level be kept above that level?

10. **SLIDE 10 EXPLAIN E85**
11. **SLIDE 11 EXPLAIN FIGURE 28-6** pump for E85 (85% ethanol and 15% gasoline). E85 is available in more locations every year
12. **SLIDES 12-14 EXPLAIN E85**

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	<p>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 the same mileage? What is price difference between regular gas & <u>E85</u>?</p>
	<p>SAFETY Discuss importance of having a fire extinguisher available when working with fuel, and of wearing PPE including safety glasses, a respirator, and gloves.</p>
	<p>DISCUSSION: Have the students discuss <u>E85</u> fuel system requirements. What additional hardware is on <u>E85</u> vehicles?</p>
	<p>15. SLIDE 15 EXPLAIN FIGURE 28-7 flex-fuel vehicle often has a yellow gas cap, which is labeled E85/gasoline.</p>
	<p>DISCUSSION: Have the students talk about enhanced fuel system <u>components & materials</u> used for <u>flex-fuel vehicles</u>. Can ethanol damage common fuel pumps? What will happen to O-rings that are not alcohol-resistant?</p>
	<p>DEMONSTRATION: Use a <u>Flex-Fuel Vehicle</u> to show students identifiers that place it in <u>E85</u> class. Talk about emissions produced by ethanol fueled vehicles.</p>
	<p>HANDS-ON TASK: Have students locate <u>VECI</u> on <u>Flex-Fuel Vehicles</u> you have in your shop. Have students share locations & information found:</p>
	<p>16. SLIDES 16 EXPLAIN Propane 17. SLIDE 17 EXPLAIN FIGURE 28-8 Propane fuel storage tank in trunk of Ford taxi.</p>

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18. **SLIDE 18 EXPLAIN** Compressed Natural Gas
19. **SLIDE 19 EXPLAIN FIGURE 28-9** The blue sticker on the rear of this vehicle indicates that it is designed to use compressed natural gas.
20. **SLIDE 20 EXPLAIN FIGURE 28-10** CNG storage tank from a Honda Civic GX shown with the fixture used to support it while it is being removed or installed in the vehicle. Honda specifies that three technicians be used to remove or install the tank through the rear door of the vehicle due to the size and weight of the tank.



DISCUSSION: Have students talk about compressed natural gas. Why is natural gas odorized during production?

DISCUSSION: Have the students discuss differences between using gasoline and CNG in vehicles. What design differences are required for a CNG engine?

21. **SLIDE 21 EXPLAIN Figure 28-11** This CNG pump is capable of supplying compressed natural gas at either 3,000 PSI or 3,600 PSI. The price per gallon is higher for the higher pressure.

DISCUSSION: Have the students discuss CNG fuel systems. What is importance of having lock-off valves in CNG vehicles?

DISCUSSION: Discuss refueling of CNG vehicles. Why is it important to fill a CNG vehicle's tank slowly?

22. **SLIDE 22 EXPLAIN DIESEL FUEL**
23. **SLIDE 23 EXPLAIN FIGURE 28-12** (a) Regular diesel fuel on the left has a clear or greenish tint, whereas fuel for off-road use is tinted red for identification. (b) A fuel pump in a farming area that clearly states the red diesel fuel is for off-road use only.
24. **SLIDE 24 EXPLAIN DIESEL & BIODIESEL**

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     	<p><u>DISCUSSION:</u> Have the students talk about grades of diesel fuel. In which applications is Grade #1 used? Why? In which applications is Grade #2 used? Why?</p> <p>25. SLIDE 25 EXPLAIN FIGURE 28-13 Biodiesel fuel is available at some locations only.</p> <p><u>HANDS-ON TASK:</u> Have students sample diesel fuel and take an API gravity reading. Have them find weight density & pounds per gallon of fuel that they are sampling.</p> <p><u>SAFETY</u> Review with students the <u>safety precautions</u> that should be taken when working With and testing, <u>diesel fuel</u>.</p> <p><u>DISCUSSION:</u> Have the students talk about <u>biodiesel blends</u>. Can <u>B20</u> be used in unmodified diesel engines? Since biodiesel costs more than regular diesel, what are its benefits?</p> <p><u>Homework:</u> complete Ch28 crossword puzzle: http://www.jameshalderman.com/links/book_intro/cw/crossword_ch_28.pdf</p>