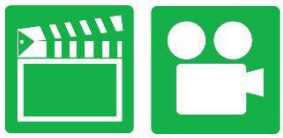
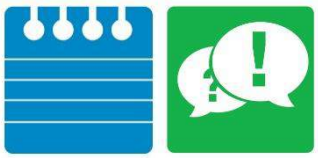
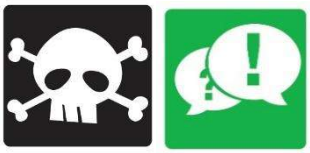
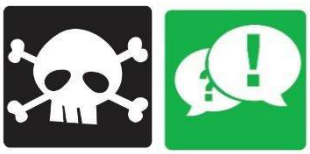
Automotive Electrical & Engine Performance 7/E

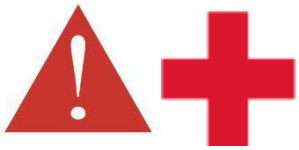
Chapter 42Hybrid Safety & Service Procedures

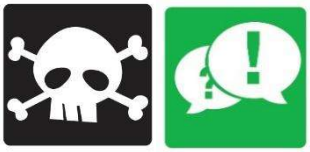
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	**This course or class covers Automotive Electrical & Engine Performance. 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 learning objectives to students as listed on NEXT SLIDE. 1. Identify the safety equipment to be used with high-voltage circuits. 2. Explain how to de-power high-voltage systems. 3. Explain the procedure to move and tow a hybrid electric vehicle (HEV). 4. Discuss the steps to perform for routine services on hybrid electric vehicles.
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.

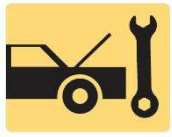
NOTE: This lesson plan is based on Automotive Electrical & Engine Performance 7/E Chapter Images found on Jim's web site @ www.jameshalderman.com
LINK CHP 42:Chapter Images

ICONS	Ch42 Hybrid Safety & Service Procedures
	1. SLIDE 1 CH42 HYBRID SAFETY & SERVICE PROCEDURES
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE REGULARLY UPDATED**
	**Videos**
	**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**
	**Crossword Puzzle (Microsoft Word) (PDF)** **Word Search Puzzle (Microsoft Word) (PDF)**
	**DISCUSS WARNING**
	2. **SLIDE 2EXPLAINFIGURE 42-1** Rubber lineman's gloves protect the wearer from a shock hazard. 3. **SLIDE 3 EXPLAINFIGURE 42-2** Wearing leather gloves over the lineman's gloves helps protect the rubber gloves from damage 4. **SLIDE 4EXPLAINFIGURE 42-3** Checking rubber lineman's gloves for pinhole leaks.
	**DISCUSSION:Have students talk about importance of using leather gloves over insulated gloves. Remind them that when purchasing leather gloves, they must be large enough to fit over insulated safety gloves. What should be done before each use of gloves?**
	FIGURES 42-1 to 42-3
	**DISCUSS WARNING**

ICONS	Ch42 Hybrid Safety & Service Procedures
	**SAFETY** Have students talk about need for safety precautions when working around & with hybrid electric vehicles. Both hybrid electric vehicles & all-electric vehicles use high-voltage circuits that cannot be touched without protection.
	**DEMONSTRATION:** Show students materials necessary to create a "High Voltage: DO NOT TOUCH" sign that can be placed on roof of HEV that is being stored.
	DISCUSS FREQUENTLY ASKED QUESTION
	5. SLIDE 5 EXPLAIN FIGURE 41-4 Be sure to only use meter that is CAT III-rated when taking electrical voltage measurements on hybrid electric or electric vehicle 6. SLIDE 6 EXPLAIN FIGURE 41-5 The meter leads should also be CAT III-rated when checking voltages on a hybrid electric vehicle.
	**DISCUSSION:** Discuss CAT III-rated DMM. Why is a CAT III-certified DMM required for taking measurements on HEVs? FIGURES 42-4 & 5
	**DEMONSTRATION:** Using a CAT III DMM, show students how to check a floating ground to identify a high-voltage leak. FIGURES 42-4 & 5
	**DISCUSSION:** Discuss identifying colors used for high voltage cables. What does blue or yellow plastic conduit mean? What does orange plastic conduit mean?
	**DISCUSSION:** Discuss insulation testers (Fluke 1587). When is an electrical insulation tester used?
	**HANDS-ON TASK:** Have the students wear insulated and leather gloves while trying to take a voltage reading using a CAT III DMM. Ask students to share their experience with the task.

ICONS	Ch42 Hybrid Safety & Service Procedures
   	**ON-VEHICLE NATEF TASK:** Identify location of hybrid vehicle high-voltage circuit disconnect (service plug) location and safety precautions. **DISCUSSION:** Discuss auxiliary batteries. Where are flood-type and AGM type batteries located? **CHART 41-1** EXPLAIN TECH TIP 7. **SLIDE 7EXPLAINFIGURE 41-6** Ford Escape Hybrid instrument panel showing vehicle in park and tachometer on "EV"instead of 0 RPM. This means that gasoline engine could start at any time depending on state-of-charge of high-voltage batteries & other factors. **DISCUSS WARNING**
  	**DEMONSTRATION: DEMO de-powering procedure on a Hybrid Electric Vehicle** **Use a cooking timerwith a bell alarm or some other audiblesignal as a way to know when the 10-minutewaiting period for HVbattery shutdown haspassed.** **DISCUSSION: Have students talk about when high voltage system needs to be de-powered& when it doesn't. When servicing a system that may contain high voltage, how can you be sure of whether or not it needs to be de-powered?** **HANDS-ON TASK: Supervise students as they de-power vehicle.**
   	EXPLAIN TECH TIP 8. **SLIDE 8EXPLAINFigure 41-7** Jump starting a 2001–2003 Toyota Prius using a 12-volt supply to boost the 12-volt auxiliary battery in the trunk. 9. **SLIDE 9EXPLAINFigure 41-8** The underhood 12-volt

ICONS	Ch42 Hybrid Safety & Service Procedures
	jump-start terminal on this 2004+_ Toyota Prius has a red plastic cover with a "+" sign. The positive booster cable clamp will attach directly to the vertical metal bracket
	**DEMONSTRATION:Show students jump starting procedures on HEV. Review safety procedures for connecting & disconnecting jumper cables. Can jump box or jumper cable from another vehicle be used on high-voltage HV battery pack?FIGURES 42-7 & 8**
	**10. SLIDE10EXPLAINFIGURE 42-9** Using a warning cover over the steering wheel helps others realize that work is being performed on the high-voltage system and that no one is to attempt to start or move the vehicle
	11. SLIDE11EXPLAINFIGURE 42-10 lock box is a safe location to keep the ignition keys of a hybrid electric vehicle while it is beingserviced.
	**DEMONSTRATION: Show procedure for moving & storing HEV waiting for parts to arrive.**
	**HANDS-ON TASK: Have the students describe safety precautions that should be taken to work on HEVs. Grade them on thoroughness and a clear understanding of dangers that HEVS present and how those dangers can be addressed.**
	**HANDS-ON TASK: Review importance of separating the keys from a hybrid vehicle to prevent an accidental start-up that could lead to personal injury. Have students create a metal lock box or research the cost of purchasing one.**
	**ON-VEHICLE NATEF TASK:Identify high-voltage circuits of hybrid electric vehicles and related safety precautions.**
	**ON-VEHICLE NATEF TASK:Identify hybrid vehicle A/C system electrical circuits**
	**12. SLIDE 12EXPLAINFigure 42-11** Insulated tools, such as this socket set, would provide an additional margin of safety to the service technician when working around high-voltage components and systems

ICONS	Ch42 Hybrid Safety & Service Procedures
	13. SLIDE13 EXPLAINFigure 42-12The high-voltage wiring on this Honda hybrid is colored orange for easy identification **SAFETY**Gather materials necessary for the students to create a "High voltage—Do not touch" sign that can be placed on roof of HEV that is being stored. FIGURES 42-10, 11, & 12 DEMONSTRATION: Show how to identify lift points for HEV from on-line service information. Using a floor jack/lift, raise vehicle and have the students take note of areas of concern on vehicle: FIGURE 42-12 HANDS-ON TASK: create a "High voltage—Do nottouch" sign that can be placed on the roof of a hybrid vehicle that is being stored..
	DISCUSS FREQUENTLY ASKED QUESTION
	EXPLAIN TECH TIP
	REAL WORLD FIX
	DISCUSSION:Have the students review the eight-step diagnosis procedure. Is diagnosing a hybrid electric vehicle different from diagnosing any other type of vehicle? HANDS-ON TASK:Have students lift an HEV supervised by the instructor
	
	ON-VEHICLE NATEF TASK: Identify hybrid engine service precautions
	DISCUSSION:Have students talk about cooling system servicefor HEVs. What considerations for servicing an HEV cooling system may differ from those for servicing ICE cooling system?

ICONS	Ch42 Hybrid Safety & Service Procedures
	**DISCUSSION:** Have the students discuss servicing the **air conditioning of an HEV**. What does the service technician need to know about the air conditioning compressor on HEV
	**DISCUSSION:** Have the students talk about the **regenerative braking system** and base brakes used on hybrid electric cars. Why do base brakes on HEVs often get stuck or function incorrectly?
	**ON-VEHICLE NATEF TASK:** Describe the operation of **HEV** regenerative braking system
	**DISCUSSION:** Have the students discuss **rolling resistance.** How does replacing tires affect fuel economy?
	**DISCUSSION:** discuss **auxiliary battery service**. What is the proper charger to use when recharging an AGM battery? Can this charger also be used on regular lead acid battery?
	14. SLIDES 14-25 LINEMAN'S GLOVES' SLIDE SHOW
	**DEMONSTRATION:** Show the students how to **inspect, test, and store HV safety gloves** and leather protectors.
	**DISCUSSION:** Have the students discuss the storage and **care of safety gloves**. What kinds of materials and products can damage rubber gloves?