Hybrids & Alternative Fuel Vehicles

Chapter 14 Toyota/Lexus Hybrid Vehicles

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. 1. Identify a Toyota/Lexus hybrid electric vehicle. 2. Explain the operation of the various unique systems found in Toyota/Lexus hybrid electric vehicles. 3. List the procedures necessary to depower the high-voltage circuits in Toyota/Lexus hybrid electric vehicles. 4. Describe how to safely perform routine service on a Toyota/Lexus hybrid electric vehicle.
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 Hybrids 4th Edition
Chapter Images found on Jim's web site @
www.jameshalderman.com
LINK CHP 14: Chapter Images

ICONS	Ch14 Toyota/Lexus Hybrid Vehicles
	**1. SLIDE 1 TITLE TOYOTA/LEXUS HYBRID VEHICLES**
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED** **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**
	**2. SLIDE 2 EXPLAIN FIGURE 14-1** second-generation Prius is larger than the first generation (upper vehicle). **3. SLIDE 3 EXPLAIN FIGURE 14-2** major components of a second-generation Prius.
	**DISCUSS FREQUENTLY ASKED QUESTION**
	**4. SLIDE 4 EXPLAIN FIGURE 14-3** Dash readouts of 2001–2003 Prius. Note "Turtle" at top right. An outline of a turtle will illuminate on right-hand side of display when the NiMH battery pack does not have a sufficient charge to provide additional torque. There is nothing wrong with vehicle; it just needs to be driven less aggressively so that generator can keep up with NiMH battery pack depletion. **5. SLIDE 5 EXPLAIN FIGURE 14-4** energy monitor screen indicates where the mechanical and electrical energy is flowing during vehicle operation. **6. SLIDE 6 EXPLAIN FIGURE 14-5** consumption screen gives feedback to the driver as to how well his or her driving style is conserving fuel.
	**DISCUSS CAUTION**

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	7. **SLIDE 7 EXPLAIN FIGURE 14-6** Toyota smart key. 8. **SLIDE 8 EXPLAIN FIGURE 14-7** All Toyota hybrid vehicles have "B" shifter position, as seen on Camry
	**DEMONSTRATION: START TOYOTA HYBRID VEHICLE WITH STUDENTS. SHOW & DEMO SMART KEY OPERATION**
	**DISCUSS FREQUENTLY ASKED QUESTION**
	9. **SLIDE 9 EXPLAIN FIGURE 14-8** to engage Park on a second-generation Prius, stop the vehicle and press the "P" button. 10. **SLIDE 10 EXPLAIN FIGURE 14-9** second-generation Prius uses an electronic sensor to replace conventional gear shift selector. 11. **SLIDE 11 EXPLAIN FIGURE 14-10** light on POWER button is off when the vehicle is in READY mode.
	**DEMONSTRATION: START TOYOTA HYBRID VEHICLE WITH STUDENTS. HAVE THEM COMPARE & CONTRAST THIS START WITH A COMBUSTION ENGINE VEHICLE START. ASK STUDENTS TO DISCUSS DIFFERENCES BETWEEN 2 STARTS.**
	**DISCUSS FREQUENTLY ASKED QUESTION**
	**EXPLAIN NOTE**
	**EXPLAIN TECH TIPS**
	12. **SLIDE 12 EXPLAIN FIGURE 14-11** When the bypass valve is closed, the exhaust gases are forced through the HC absorber, which stores unburned hydrocarbons until the TWC is up to temperature

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	**DISCUSS FREQUENTLY ASKED QUESTION**
	**HANDS-ON TASK:** HAVE STUDENTS LABLE THE FUEL SYSTEM COMPONENTS ON A PRIUS
	**EXPLAIN NOTE**
	**EXPLAIN TECH TIP**
	13. **SLIDE 13 EXPLAIN FIGURE 14-12** Prius stores its fuel in a resin bladder located inside a steel tank. 14. **SLIDE 14 EXPLAIN FIGURE 14-13 F**irst-generation Prius battery pack with 38 modules. All of the battery cells are connected in series to create the HV battery. 15. **SLIDE 15 EXPLAIN FIGURE 14-14** electronic controls used in a Toyota hybrid vehicle. Notice the system main relays (SMR), battery ECU, and the interconnection of the various components and systems. 16. **SLIDE 16 EXPLAIN FIGURE 14-15** High-voltage battery pack cooling on a second-generation Prius
	**DISCUSS REAL WORLD FIX** **DISCUSS FREQUENTLY ASKED QUESTION**
	17. **SLIDE 17 EXPLAIN FIGURE 14-16** under hood view of the Toyota hybrid system on a Toyota Camry with all covers in place.
	**DISCUSS FREQUENTLY ASKED QUESTION**
	18. **SLIDE 18 EXPLAIN FIGURE 14-17a** Toyota Hybrid System operation. 19. **SLIDE 18 EXPLAIN FIGURE 14-17b** Toyota Hybrid System operation. 20. **SLIDE 20 EXPLAIN FIGURE 14-18** Powertrain schematic for the 4WD versions of the Highlander Hybrid and RX400h. Note that MGR alone is used to

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	drive the vehicle's rear wheels. **21. SLIDE 21 EXPLAIN FIGURE 14-19** inverter assembly from a first generation Prius. The inverter performs multiple functions in the THS system.
	**EXPLAIN NOTE**
	**22. SLIDE 22 EXPLAIN FIGURE 14-20** Air vent at the front edge of the rear seat in a Lexus RX 400h. This vent has to be kept clear to ensure proper battery operation. **23. SLIDE 23 EXPLAIN FIGURE 14-21** boost converter is used to increase HV battery voltage to as high as 650 volts for use by the electric motors. **24. SLIDE 24 EXPLAIN FIGURE 14-22** rear-mounted electric motor (MGR) is used on four-wheel-drive versions of the Lexus RX 400h & Toyota Highlander.
	**25. SLIDE 25 EXPLAIN FIGURE 14-23** EPS unit on a Toyota Highlander hybrid is powered by 42 volts supplied by a separate DC-DC converter. **26. SLIDE 26 EXPLAIN FIGURE 14-24** Camry hybrid electric vehicle does not look any different from a regular Camry except for the emblem on side and rear of vehicle. **27. SLIDE 27 EXPLAIN FIGURE 14-25** Camry Hybrid battery pack as viewed from the passenger compartment. Note the cooling fan assembly on top of the battery case. **28. SLIDE 28 EXPLAIN FIGURE 14-26** 2007 Camry Hybrid inverter assembly is more compact than those found in previous Toyota HEVs.
	**DISCUSS FREQUENTLY ASKED QUESTION**
	**DISCUSS CAUTION**
	**29. SLIDE 29 EXPLAIN FIGURE 14-27** high-voltage (HV) service plug being removed on a second-generation Prius. The handle must be lifted straight up before rotating to the left for removal

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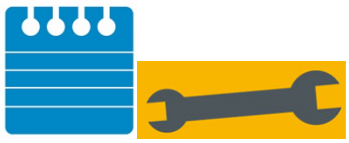
	**DEMONSTRATION: SHOW THE LOCATION OF A SERVICE PLUG ON A PRISUS**
	**DISCUSSION: HAVE THE STUDENTS DISCUSS THE USE OF THE SERVICE PLUG. WHY IS IT IMPORTANT TO REMOVE IT WHEN SERVICING A TOYOTA HEV?**
	**EXPLAIN NOTE** **EXPLAIN TECH TIP**
	30. **SLIDE 30 EXPLAIN FIGURE 14-28** Verify that system has been de-energized using a DMM before touching any part of the high-voltage system. 31. **SLIDE 31 EXPLAIN FIGURE 14-29** Removing service plug on Highlander Hybrid. Service plug is located behind plastic panel on left side of rear seat
	**HANDS-ON-TASK: HAVE STUDENTS REMOVE PRIUS SERVICE PLUG. VERIFY THAT SYSTEM HAS BEEN DE-ENERGIZED USING A DMM BEFORE TOUCHING ANY PART OF THE HIGH-VOLTAGE SYSTEM: SEE FIGURE 14-28**
	**EXPLAIN TECH TIP**
	32. **SLIDE 32 EXPLAIN FIGURE 14-30a** Toyota computer system monitors the voltage on the chassis and stands by ready to disable the high-voltage system if a connection to ground is detected. 33. **SLIDE 33 EXPLAIN FIGURE 14-30b** Toyota computer system monitors the voltage on the chassis and stands by ready to disable the high-voltage system if a connection to ground is detected.
	34. **SLIDE 34 EXPLAIN FIGURE 14-31** insulation tester is used to detect any electrical connection between the high-voltage wiring and chassis of the vehicle. 35. **SLIDE 35 EXPLAIN FIGURE 14-32** While some aftermarket scan tools will give some hybrid data, it is wise to use the factory tool and service information.
	**EXPLAIN TECH TIPS**

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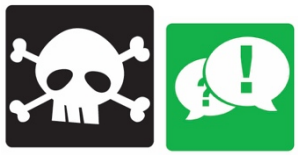
	**EXPLAIN NOTE**
	**DISCUSS REAL WORLD FIX**
	**DISCUSS WARNING**
	**36. SLIDE 36 EXPLAIN FIGURE 14-33** high-voltage disconnect plug on a second-generation Prius (2004+) includes a 125-ampere fuse. Always wear protective 1,000+ volt linesman's gloves with protective leather gloves over them when disconnecting this plug. **DISCUSS CAUTION**
	**DISCUSS REAL WORLD FIX**
	**37. SLIDE 37 EXPLAIN FIGURE 14-34** Note that Toyota's Super Long Life Coolant is pre-diluted
	**EXPLAIN TECH TIP**