Automotive Engines
Chapter 24 Engine Removal & Disassembly
Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This engine systems course or class provides complete coverage of the components, operation, design, and troubleshooting. It correlates material to task lists specified by ASE and NATEF and emphasizes a problem-solving approach. Chapter features include Tech Tips, Frequently Asked Questions, Real World Fixes, Videos, Animations, and NATEF Task Sheet references.
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 as listed on the second SLIDE. 1. Prepare for ASE Engine Repair (A1) certification test content areas "B" (Cylinder Head and Valve Train Diagnosis and Repair) and "C" (Engine Block Diagnosis and Repair). 2. Explain the differences between a long block and a short block assembly. 3. Describe how to remove an engine from a vehicle. 4. Explain how to remove engine accessory components, such as the covers and valve train components. 5. Discuss how to remove cylinder heads without causing warpage. 6. List the steps necessary to remove a piston from a cylinder. 7. Explain how to remove a valve from a cylinder head.
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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	1. SLIDE 1 CH 24 ENGINE REMOVAL & DISASSEMBLY 2. **SLIDES 2-3** EXPLAIN Objectives & KEY TERMS 4. **SLIDES 4-5** EXPLAIN Engine Repair Options 6. **SLIDE 6** EXPLAIN **FIGURE 24-1** worn timing sprocket that resulted in a retarded valve timing and reduced engine performance. 7. **SLIDE 7** EXPLAIN **FIGURE 24-2** crate engine from Chrysler to be used in a restored muscle car. Using complete new engine costs more than rebuilding an existing engine, but has warranty and uses all new parts.
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS UPDATED REGULARLY**
	**A minor repair on one vehicle can be a major repair in another. EG: most people would think that an oil pan gasket is a minor repair, but on some vehicles, entire engine must be removed to access oil pan.**
	**CRATE ENGINES are usually for dealership replacement in vehicles under warranty with low mileage. Costs for just engine can be $4,000 or more!**
	**DEMONSTRATION: Show students how to identify an engine in order to replace it. This includes knowing how to decode the VIN & finding certification labels.**
	**HANDS-ON TASK: Have students locate & identify different engines in the shop as if they were going to replace them. Be sure to have them decode VIN.**
	**Be sure to reference ON-LINE SERVICE INFORMATION before attempting to remove engine. Some engines can be much harder to remove and install than others. ENGINES TODAY ARE INSTALLED FROM BOTTOM**
	8. **SLIDE 8** EXPLAIN **Engine Removal**

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	**9. SLIDE 9 EXPLAIN TECH TIP**
	**10. SLIDE 10 EXPLAIN TECH TIP**
	**11. SLIDE 11 EXPLAIN** Engine Removal **12. SLIDE 12 EXPLAIN FIGURE 24-3** An engine must be tipped as it is pulled from the chassis. **13. SLIDE 13 EXPLAIN FIGURE 24-4** When removing just the engine from a front-wheel drive vehicle, the transaxle must be supported. Shown here is a typical fixture that can be used to hold the engine if the transaxle is removed or to hold the transaxle if engine is removed.
	**OPTIONAL ANIMATION: Engine Removal www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_Animation/Chapter24_Fig_24_3/index.htm
	**14. SLIDE 14 EXPLAIN FIGURE 24-5** entire cradle, which included engine, transaxle, and steering gear, was removed and placed onto a stand. Rear cylinder head has been removed to check for root cause of a coolant leak.
	**DEMONSTRATION: Show students how to properly use a transverse engine support bracket.**
	**HANDS-ON TASK: Have students set up transverse engine support bracket on LAB VEHICLE**
	**ON-VEHICLE NON-NATEF TASK: Remove and reinstall engine in an OBD II or newer vehicle; reconnect all attaching components & restore vehicle to running condition.**
	**Show VALVE TRAIN COMPONENTS VIDEO: 1.5 MINUTES www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_mylabs/akamai/template/video640x480.php?title=Valvetrain%20Components&clip=pandc/chet/2012/automotive/Auto_Parts_Specialist/Exp3.mov&caption=chet/chet_mylabs/akamai/2012/automotive/Auto_Parts_Specialist/xml/Exp3.xml
	**15. SLIDE 15 EXPLAIN Engine Disassembly & EXPLAIN FIGURE 24-6** Always use graded bolts—either grade 5 or 8 bolts—whenever mounting an engine to a stand

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	**16. SLIDE 16** EXPLAIN **FIGURE 24-7** Keeping pushrods and lifters sorted by cylinder, including spark plugs, is a wise way to proceed when disassembling cylinder heads **17. SLIDE 17** EXPLAIN **FIGURE 24-8** Sometimes after the cylinder head has been removed, the engine condition is discovered to be so major that the entire engine may need to be replaced rather than overhauled
	**Use an engine parts holder to help keep parts organized.**
	**18. SLIDE 18** EXPLAIN TECH TIP
	**DISCUSSION: Ask students if using machine shop to perform certain engine repairs (valve job) is better or worse than having technician do job themselves. Have them explain their reasoning.**
	**19. SLIDE 19** EXPLAIN Disassembly of Short Block & EXPLAIN **FIGURE 24-9** connecting rods were numbered from the factory. If they are not, then they should be marked.
	**DEMONSTRATION: Show students how to identify rod caps, main bearing caps, and camshaft journals. Include bearings as well so students will be able to understand how they work.**
	**20. SLIDE 20** EXPLAIN **FIGURE 24-10** Most of the cylinder wear is on the top inch just below the cylinder ridge. This wear is due to the heat and combustion pressures that occur when the piston is near the top of the cylinder. **21. SLIDE 21** EXPLAIN **FIGURE 24-11** This ridge is being removed with one type of ridge reamer before the piston assemblies are removed from the engine.
	**22. SLIDE 22** EXPLAIN TECH TIP
	**Show ANIMATION: Directional Markings on Crankshaft** **www.myautomotivelab.com** http://media.pearsoncmg.com/ph/chet/chet_myautomotivelab_2/animations/A1_Animation/Chapter24_Fig_24_14/index.htm

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	**23. SLIDES 23** EXPLAIN Rotating Engines Assembly Removal & EXPLAIN **Figure 24-12** Puller being used to pull the vibration damper from the crankshaft.
	**An engine vibration dampener (harmonic balancer) is made up of 2 pieces that are held together by a rubberlike substance to absorb the vibration. Sometimes rubber material can tear, causing a possible timing issue or other performance problems.**
	**24. SLIDE 24** EXPLAIN **FIGURE 28-13** When the timing chain cover was removed, the broken timing gear explained why this GM 4.3 liter V-6 engine stopped running
	25. SLIDE 25 EXPLAIN **FIGURE 24-14** Most engines such as this Chevrolet V-8 with four-bolt main bearing caps have arrows marked on the bearing caps which should point to the front of the engine.
	26. SLIDE 26 EXPLAIN **FIGURE 24-15** This small block Chevrolet V-8 had water standing in the cylinders, causing a lot of rust, which was discovered as soon as the head was removed.
	**ON-VEHICLE NON-NATEF TASK:** **Disassemble engine block; clean and prepare components for inspection and reassembly**
	**DEMONSTRATION: Show students how to measure a cylinder bore. Most measurements will be taken to 0.0001" (one ten-thousandth of an inch). Measurements this precise cannot be seen or felt with fingers.**
	**HANDS-ON TASK: Have students measure cylinder bores on an engine. Have them write down their measurements and identify any that are out of specification.**
	**DISCUSSION: Ask students if 0.100" is same as 0.1". (It is not, because other zeros display accuracy in measurement.)**
	**27. SLIDE 27** EXPLAIN TECH TIP

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	**28. SLIDE 28** EXPLAIN TECH TIP **FIGURE 24-16** torch is used to heat gallery plugs. Paraffin wax is then applied and allowed to flow around the threads. This procedure results in easier removal of the plugs and other threaded fasteners that cannot otherwise be loosened.
	**DEMONSTRATION: Show students the proper equipment used to secure and hold cylinder heads. Cylinder heads should never laid flat on a table.**
	**29. SLIDE 29** EXPLAIN **FIGURE 24-17** valve spring compressor is used to compress the valve spring before removing the keepers (locks)
	**30. SLIDE 30** EXPLAIN TECH TIP
	**HANDS-ON TASK: Have students remove crankshaft and head from an engine. Then have them properly reinstall them.**
	**ON-VEHICLE NATEF TASK: Remove cylinder head; inspect gasket condition; install cylinder head, gasket; tighten according to specifications & procedures: PAGE 107**
	**DISCUSSION: Most technicians do not rebuild the entire engine on their own. Ask students what jobs a technician would contract out and why. The most common reasons are time and cost savings**
	**SEARCH INTERNET: Have students use Internet to search for additives for engine protection and repair. Have them prepare to report to the class on five different additives and what they do. Also ask them to comment on any reviews they found about the additives and whether they would use any of additives in their own vehicles.**
	**Talk through SUMMARY and questions**
	**HOMEWORK: complete Ch24 crossword puzzle: http://www.jameshalderman.com/links/book_engine_theory_serv_7/cw/crossword_ch_24.pdf**