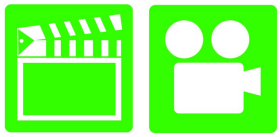
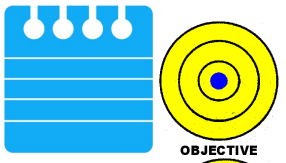
A8 Engine Performance 4th Edition

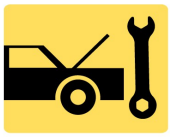
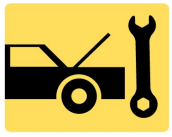
Chapter 9 Lubrication System Operation & Diagnosis

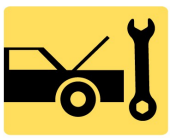
Opening Your Class

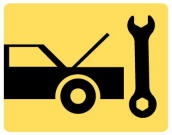
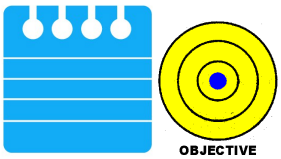
KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Automotive Engine Performance.** It correlates material to task lists specified by ASE and NATEF.
Motivate Learners	Explain how the knowledge of how something works translates into the ability to use that knowledge 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 the chapter learning objectives to the students. 1. Prepare for Engine repair (A1) ASE certification test content area "D" (Lubrication and Cooling Systems Diagnosis and Repair). 2. Describe how coolant flows through an engine. 3. Discuss the operation of the thermostat. 4. Explain the purpose and function of the radiator pressure cap. 5. Describe the various types of antifreeze and how to recycle and discard used coolant. 6. Discuss how to diagnose cooling system problems.
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.

ICONS	Ch09 Lubrication System OP & Diagnosis
	1. SLIDE 1 CH9 LUBRICATION SYSTEM OPERATION & DIAGNOSIS
	Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/ WEB SITE REGULARLY UPDATED
	POWER POINTS DONE BY INDIVIDUAL LEARNING OBJECTIVES, SO THERE IS POWER POINT FILE FOR EACH LEARNING OBJECTIVE
	2. SLIDE 2 EXPLAIN OBJECTIVE CH8 AEP_LO1 3. SLIDES 3-4 EXPLAIN Lubrication Principles
	ANIMATION OIL FLOW-WORLD ENGINE
	WHEN PERFORMING OIL CHANGE IT IS RECOMMENDED THAT ENGINE BE AT OPERATING TEMPERATURE & ENGINE BE RUN JUST BEFORE OIL IS DRAINED. THIS IS DONE IN ORDER TO CIRCULATE AND SUSPEND HEAVY DIRT PARTICLES SO THAT THEY CAN DRAIN OUT WITH OIL.
	DISCUSSION: DISCUSS THAT TODAY'S VEHICLES USE AN ENGINE OIL LIFE INDICATOR, LOCATED IN DRIVER INFORMATION CENTER. THE DISPLAY SHOWS PERCENTAGE OF ENGINE OIL LIFE LEFT OR TURNS ON A LIGHT ALERTING DRIVER THAT THE OIL SHOULD BE CHANGED
	5. SLIDE 5 EXPLAIN Figure 9-1 Oil molecules cling to metal surfaces but easily slide against each other. 6. SLIDE 6 EXPLAIN Figure 9-2 Wedge-shaped oil film developed below a moving block. 7. SLIDE 7 EXPLAIN Figure 9-3 Wedge-shaped oil film curved around a bearing journal 8. SLIDES 8-10 EXPLAIN Engine Lubrication Systems
	

ICONS	Ch09 Lubrication System OP & Diagnosis
	WITH MANY OIL PRESSURE INDICATOR LIGHTS, ENGINE OIL PRESSURE MUST BE VERY LOW (UNDER 10 PSI AT IDLE) BEFORE WARNING LIGHT IS TRIGGERED. ENGINE BEARING KNOCK OR LIFTER NOISE MAY BE EVIDENT BEFORE LIGHT IS ILLUMINATED.
DEMO	**DEMONSTRATION: SHOW STUDENTS OIL FILTER WITH DECOMPOSED OIL AND COMPARE IT TO A NEW ONE. EXPLAIN WHY OIL AND OIL FILTER MUST BE CHANGED AT APPROPRIATE INTERVALS TO PREVENT DIRTY, BROKEN DOWN OIL FROM CAUSING SERIOUS DAMAGE TO ENGINE**
	A MAJOR CAUSE OF PREMATURE ENGINE BREAKDOWN IS FAILURE TO CHANGE OIL AND FILTER AS RECOMMENDED BY OEM. EXCESSIVE HEAT AND MECHANICAL STRESS CAN CAUSE OIL TO DECOMPOSE AND THICKEN.
We Support NATEF	**ON-VEHICLE NATEF TASK: INSPECT, TEST, AND REPLACE OIL TEMPERATURE AND PRESSURE SWITCHES AND SENSORS.**
	11. **SLIDE 11 EXPLAIN FIGURE 9-4** oil pump driven by the camshaft. 12. **SLIDE 2 EXPLAIN FIGURE 9-5** operation of a rotor-type oil pump 13. **SLIDE 13 EXPLAIN FIGURE 9-6** typical internal/external oil pump mounted in the front cover of the engine that is driven by the crankshaft. 14. **SLIDES 14 EXPLAIN FIGURE 9-7** Gerotor-type oil pump driven by the crankshaft. 15. **SLIDE 15 EXPLAIN FIGURE 9–8** In a gear-type oil pump, the oil flows through the pump around the outside of each gear. This is an example of a positive displacement pump, where everything entering the pump must leave the pump
	HANDS-ON TASK: HAVE A GROUP OF STUDENTS DEMONSTRATE TO THE CLASS HOW GEAR TYPE OIL PUMP WORKS AND HOW IT DIFFERS FROM A CAMSHAFT-DRIVEN OIL PUMP.

ICONS	Ch09 Lubrication System OP & Diagnosis
	**HANDS-ON TASK: HAVE STUDENTS INSPECT A NUMBER OF WORN PARTS FROM AN ENGINE LUBRICATION SYSTEM AND DESCRIBE THE EVIDENCE THAT INDICATES WEAR AND HOW EACH PART GOT TO BE WAY IT IS.**
	16. **SLIDES 16-17 EXPLAIN** Oil Pressure Regulation 18. **SLIDE 18 EXPLAIN Figure 9-9** Oil pressure relief valves are spring loaded. The stronger the spring tension, the higher the oil pressure. 19. **SLIDE 19 EXPLAIN Figure 9-10** Typical engine design that uses both pressure and splash lubrication. Oil travels under pressure through galleries (passages) to reach top of engine. Other parts are lubricated as oil flows back down into oil pan or is splashed onto parts. 20. **SLIDES 20-24 EXPLAIN** Factors Affecting Oil Pressure
 	2. **SLIDE 2 EXPLAIN OBJECTIVE CH8 AEP_LO2** 3. **SLIDE 3 EXPLAIN Oil Pump Checks**
	4. **SLIDE 4 EXPLAIN Figure 9-11 (a)** visual inspection indicated that this pump cover was worn. **(b)** embedded particle of something was found on one of the gears, making this pump worthless except for scrap metal. 5. **SLIDE 5 EXPLAIN Figure 9-12 (a)** oil pump is the only part in an engine that gets unfiltered engine oil. The oil is drawn up from the bottom of the oil pan and is pressurized before flowing to the oil filter. **(b)** If debris gets into an oil pump, the drive or distributor shaft can twist and/or break. When this occurs, the engine will lose all oil pressure
 	**ON-VEHICLE NATEF TASK: INSPECT OIL PUMP GEARS OR ROTORS, HOUSING, PRESSURE RELIEF DEVICES, & PUMP DRIVE; PERFORM NECESSARY ACTION.**
	**External Gear Oil Pump** **Gerotor Pump - Slow** **Gerotor - Type Oil Pump** **Internal-External Gear Pump with Crescent**

ICONS	Ch09 Lubrication System OP & Diagnosis
	6. **SLIDES 6-7 EXPLAIN** Oil Passages in block 8. **SLIDE 8 EXPLAIN Figure 9-13** An intermediate shaft drives the oil pump on this overhead camshaft engine. Note the main gallery and other drilled passages in the block and cylinder head.
	9. **SLIDES 9-10 EXPLAIN** Valve Train Lubrication 11. **SLIDE 11 EXPLAIN Figure 9-14** Oil is sent to rocker arms on this Chevrolet V-8 engine through hollow pushrods. Oil returns to oil pan through oil drainback holes in cylinder head
	**DISCUSSION: DISCUSS COMMON LOCATIONS OF OIL GALLERIES IN AN ENGINE BLOCK AND HOW OIL FLOWS THROUGH HOLLOW PUSH RODS TO THE ROCKER ARMS.**
	**HANDS-ON TASK: HAVE STUDENTS INSPECT A NUMBER OF WORN PARTS FROM AN ENGINE LUBRICATION SYSTEM AND DESCRIBE THE EVIDENCE THAT INDICATES WEAR AND HOW EACH PART GOT TO BE THE WAY IT IS.**
	**CHECK WITH OEM BEFORE USING OIL ADDITIVES. SOME OEMS WILL VOID THE ENGINE WARRANTY IF UNAPPROVED ADDITIVES ARE FOUND IN OIL.**
	**ON-VEHICLE NATEF TASK: RESEARCH APPLICABLE VEHICLE & SERVICE INFORMATION, VEHICLE SERVICE HISTORY, SERVICE PRECAUTIONS, & TSBS**
	12. **SLIDES 12-13 EXPLAIN Oil Pans**
	14. **SLIDE 14 EXPLAIN Figure 9-15** typical oil pan with a built-in windage tray used to keep oil from being churned up by the rotating crankshaft. 15. **SLIDE 15 EXPLAIN FIGURE 9–16** straightedge and a feeler gauge are being used to check that the oil pan has been correctly installed on the 5.7-liter Chevrolet V-8 engine. The oil pan is part of the engine itself and must be properly installed to ensure that other parts attached to the engine are not being placed in a bind.

ICONS	Ch09 Lubrication System OP & Diagnosis
	**DEMONSTRATION: SHOW STUDENTS AN OIL PAN WITH A BUILT-IN WINDAGE TRAY. HAVE STUDENTS DISCUSS THE BENEFITS OF THIS CONFIGURATION.**
	**ANIMATION: ENGINE LUBRICATION WET SUMP WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A1_ANIMATION/CHAPTER16_FIG_16_14/INDEX.HTM
	**ANIMATION: DRY SUMP OIL SYSTEM**
	16. **SLIDE 16 EXPLAIN FIGURE 9–17** A typical engine oil cooler. Engine coolant flows through the cooler adjuster that fits between the engine block and the oil filter
	**ON-VEHICLE NATEF TASK: INSPECT AUXILIARY OIL COOLERS; DETERMINE NECESSARY ACTION.**
	**DEMONSTRATION: SHOW STUDENTS OIL COOLER. TALK ABOUT THE POSSIBLE APPLICATIONS OF OIL COOLERS. INDICATE THAT SOME OIL COOLERS USE ENGINE COOLANT TO TRANSFER HEAT FROM OIL TO ENGINE COOLING SYSTEM**
	**HANDS-ON TASK: HAVE A GROUP OF STUDENTS DISASSEMBLE AN ENGINE OIL COOLER. HAVE A SECOND GROUP OF STUDENTS REASSEMBLE OIL COOLER.**
	17. **SLIDES 17-18 EXPLAIN** Oil Pressure Warning Lamp 19. **SLIDE 19 EXPLAIN FIGURE 9–18** The oil pressure switch is connected to a warning lamp that alerts the driver of low oil pressure. 20. **SLIDE 20 EXPLAIN FIGURE 9–19** A typical oil pressure sending unit on a Ford V-8.
	**0. SLIDE 0 EXPLAIN OBJECTIVE CH8 AEP_LO3** **REPEAT OF AEP_LO2**