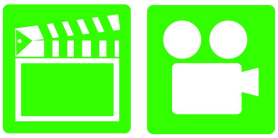
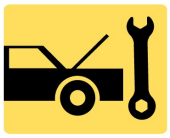
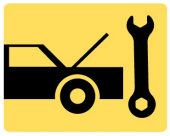
Manual Drive Train and Axles 1st Edition

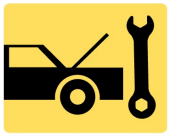
Chapter 12 Drive Axles and Differentials

Opening Your Class

KEY ELEMENT	EXAMPLES
Introduce Content	This course or class covers operation and service of **Manual Drive Trains and Axles.** 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 the Manual Drivelines and Axles (A2) ASE certification test content area "C" (Transmission/Transaxle Diagnosis and Repair) 2. Discuss the different drive axle designs. 3. Explain the features of ring and pinion gears. 4. Discuss the types of differential carriers. 5. State the purpose of differentials and identify the parts of a differential assembly. 6. Identify the different types of limited slip differentials.
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	Ch12 Drive Axles and Differentials
	**1. SLIDE 1 DRIVE AXLES & DIFFERENTIALS** 2. SLIDES 2-3 EXPLAIN OBJECTIVES
	**Check for ADDITIONAL VIDEOS & ANIMATIONS @ http://www.jameshalderman.com/** **WEB SITE IS CONSTANTLY UPDATED**
	4. **SLIDES 4-5 EXPLAIN** Drive Axle Designs 6. **SLIDE 6 EXPLAIN Figure 12–3** typical retainer-plate-type axle, which uses a ball bearing and uses a bearing retainer ring which is a press fit into the axle shaft. 7. **SLIDE 7 EXPLAIN Figure 12–4** C-lock type axle uses a straight roller bearing, lubricated by drive axle lube. 8. **SLIDE 8 EXPLAIN Figure 12–5** In a full-floating axle the axle itself slides through the center of the wheel hub assembly and does not support the weight of the vehicle.
	**DEMONSTRATION: SHOW INSIDE WORKINGS OF THE DIFFERENTIAL AND POINT OUT THE MAJOR COMPONENTS**.
	9. **SLIDES 9-11 EXPLAIN** Features of Ring & Pinion Gears 12. **SLIDE 12 EXPLAIN Figure 12–6** hypoid gear set uses a drive pinion that meshes with the ring gear below the center line of the ring gear. 13. **SLIDE 13 EXPLAIN Figure 12–8** drive side is the convex side of the ring gear except for some front axles used in four-wheel vehicles, and they often use the concave side on the drive side.
	**DISCUSSION: DISCUSS REASON FOR USING A HYPOID GEAR SET AS COMPARED TO A STANDARD BEVELED GEAR ARRANGEMENT**
	**DISCUSSION: DISCUSS THE DESIGN OF RING AND PINION THAT QUALIFIES IT AS A HYPOID GEAR ASSEMBLY**.
	14. **SLIDE 14 EXPLAIN Figure 12–9a** During drive condition, the pinion gear is driving the ring gear and there is backlash at the coast side of the ring gear tooth. 15. **SLIDE 15 EXPLAIN Figure 12–9b** During coast condition, action is reversed.

ICONS	Ch12 Drive Axles and Differentials
	**DISCUSSION:** DISCUSS GEAR RATIOS AND ADVANTAGES AND DISADVANTAGES OF LOW AND HIGH RATIOS.
	**DEMONSTRATION:** SHOW HOW TO ROUGHLY **DETERMINE GEAR RATIO** OF A DIFFERENTIAL AS DESCRIBED IN THE TEXT.
	**DISCUSSION:** DISCUSS THE PROCEDURE FOR DETERMINING GEAR RATIO WITHOUT OPENING THE DIFFERENTIAL. HAVE THEM EXPLAIN WHY THIS MIGHT BE HELPFUL FOR SERVICE
	**DISCUSSION:** DISCUSS ADVANTAGES AND DISADVANTAGES OF HUNTING AND NON-HUNTING GEAR COMBINATION. HAVE THEM DISCUSS WHY NON-HUNTING GEAR SETS HAVE TIMING MARKS.
	**HANDS-ON-TASK:** HAVE THE STUDENTS USE MATHEMATICS TO FIGURE RATIO OF SEVERAL GEAR SETS. GIVE THEM DIAGRAMS OF A DOZEN RING AND PINION SETS. HAVE THEM DETERMINE WHETHER EACH SET IS **HUNTING, NON-HUNTING, PARTIAL NON-HUNTING.**
	**DEMONSTRATION:** SHOW HOW TORQUE FLOWS THROUGH A STANDARD OPEN DIFFERENTIAL. SHOW THEM A STANDARD OPEN DIFFERENTIAL WITH THE COVER OFF. WHILE TURNING PINION FLANGE, HAVE A STUDENT HOLD ONE AXLE. TORQUE FLOWS TO FREE AXLE. AS STUDENT RELEASES HELD AXLE, BOTH WILL BEGIN TO TURN
	**HANDS-ON-TASK:** HAVE STUDENTS DETERMINE GEAR RATIO OF A DIFFERENTIAL WITHOUT OPENING DIFFERENTIAL. HAVE THEM COMPARE THEIR RESULT WITH THE OEM INFORMATION ON THE GEAR RATIO OF THE DIFFERENTIAL
	16. **SLIDE 16 EXPLAIN Figure 12–9c** During float condition, lash is split between both sides of tooth.
	**DEMONSTRATION:** SHOW RING GEAR, INCLUDING HEEL, TOE, ROOT, DRIVE SIDE, AND DECELERATION SIDE.

ICONS	Ch12 Drive Axles and Differentials
	17. **SLIDE 17 EXPLAIN Figure 12–10** reverse-cut gear set is a mirror image of the normal hypoid gear set. 18. **SLIDE 18 EXPLAIN Figure 12–11** Two front drive axles. The left one has a standard-cut ring and pinion, whereas the one at the right has high-pinion, reverse-cut ring and pinion gears.
	19. **SLIDE 19 EXPLAIN** Types of Differential Carriers 20. **SLIDE 20 EXPLAIN Figure 12–14** A removal carrier such as this Ford 9 inch unit. This older design uses an axle housing that is often called a "banjo" because of the shape, which is similar to the musical instrument.
	**DEMONSTRATION: SHOW AN EXAMPLE OF A PINION GEAR AND CARRIER ASSEMBLY. SHOW LOCATION OF ALL MAJOR COMPONENTS OF THE CARRIER ASSEMBLY**
	21. **SLIDE 21 EXPLAIN Figure 12–15** integral carrier axle assembly is most commonly used design of drive axle. 22. **SLIDE 22 EXPLAIN** Purpose of Differentials and Parts of Differential Assembly
	**HANDS-ON-TASK: HAVE THE STUDENTS IDENTIFY THE COMPONENTS OF A TYPICAL DIFFERENTIAL ASSEMBLY.**
	**DIFFERENTIAL GEARS** **WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYLABS/AKAMAI/TEMPLATE/VIDEO640X480.PHP?TITLE=DIFFERENTIAL%20GEARS&CLIP=PANDC/CHET/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/CLIP31DIFFGEARS1.MOV&CAPTION=CHET/CHET_MYLABS/AKAMAI/2012/AUTOMOTIVE/AUTO_SHOP_SAFETY/XML/CLIP31DIFFGEARS1.XML
	**DIFFERENTIAL COMPONENTS** **WWW.MYAUTOMOTIVELAB.COM** HTTP://MEDIA.PEARSONCMG.COM/PH/CHET/CHET_MYAUTOMOTIVELAB_2/ANIMATIONS/A8_ANIMATION/CHAPTER98_FIG_98_2/INDEX.HTM
	23. **SLIDE 23 EXPLAIN Figure 12–16** When the vehicle turns a corner, the inner wheel slows and the outer wheel increases in speed to compensate. This difference in rotational speed causes the pinion gears to "walk" around the slower side gear. 24. **SLIDE 24 EXPLAIN Figure 12–17** A close-up view of the side gears and spider (pinion) gear. Note the ridges on the gear teeth. These ridges are manufactured into the gear teeth to help retain lubricant so that no metal-to-metal contact occurs.

ICONS	Ch12 Drive Axles and Differentials
	25. SLIDE 25 EXPLAIN Types of Limited Slip Differentials
	**DEMONSTRATION:** SHOW COMPLETE DIFFERENTIAL ASM. DEMONSTRATE HOW TURNING PINION TRANSFERS ROTATION OF AXLE SHAFTS 90 DEGREES FROM ROTATION OF PINION.
	**DIFFERENTIAL ACTION**
	**DEMONSTRATION:** SHOW LIMITED SLIP DIFFERENTIAL ASSEMBLY. SHOW HOW CLUTCHES CONNECT SMALL PINION GEARS TO CASE.
	BECAUSE OF CLUTCHES & SPRINGS IN DIFFERENTIAL, YOU CAN USUALLY TELL IF A VEHICLE HAS A LIMITED SLIP DIFFERENTIAL BY ROTATING TIRES WHEN CAR IS LIFTED. IF BOTH TIRES ROTATE IN SAME DIRECTION, CAR HAS A LIMITED SLIP DIFFERENTIAL.
	**DEMONSTRATION:** SHOW DISASSEMBLED LIMITED SLIP DIFFERENTIAL. SHOW THEM HOW COMPRESSION OF THE CLUTCH PACKS LOCKS THE GEARS TO THE CASE
	**DEMONSTRATION:** SHOW CONE DIFFERENTIALS DISASSEMBLED SO THEY CAN SEE HOW THE CONE IS FORCED INTO ITS SEAT TO MAKE A DIRECT LINK BETWEEN GEAR AND THE CASE
  QUESTION	**DISCUSSION**: DISCUSS THE ADVANTAGES OF THE LIMITED SLIP DIFFERENTIAL IN CERTAIN SITUATIONS.
	26. SLIDES 26-27 EXPLAIN Summary