Auto Engine Repair

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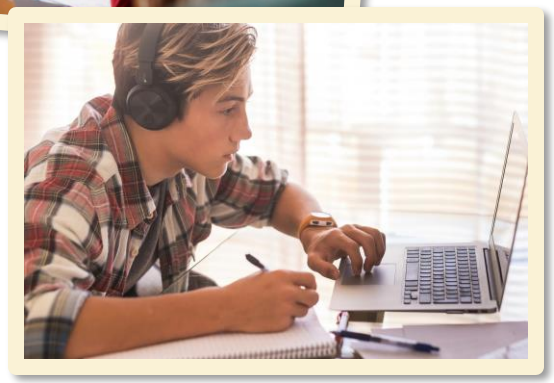

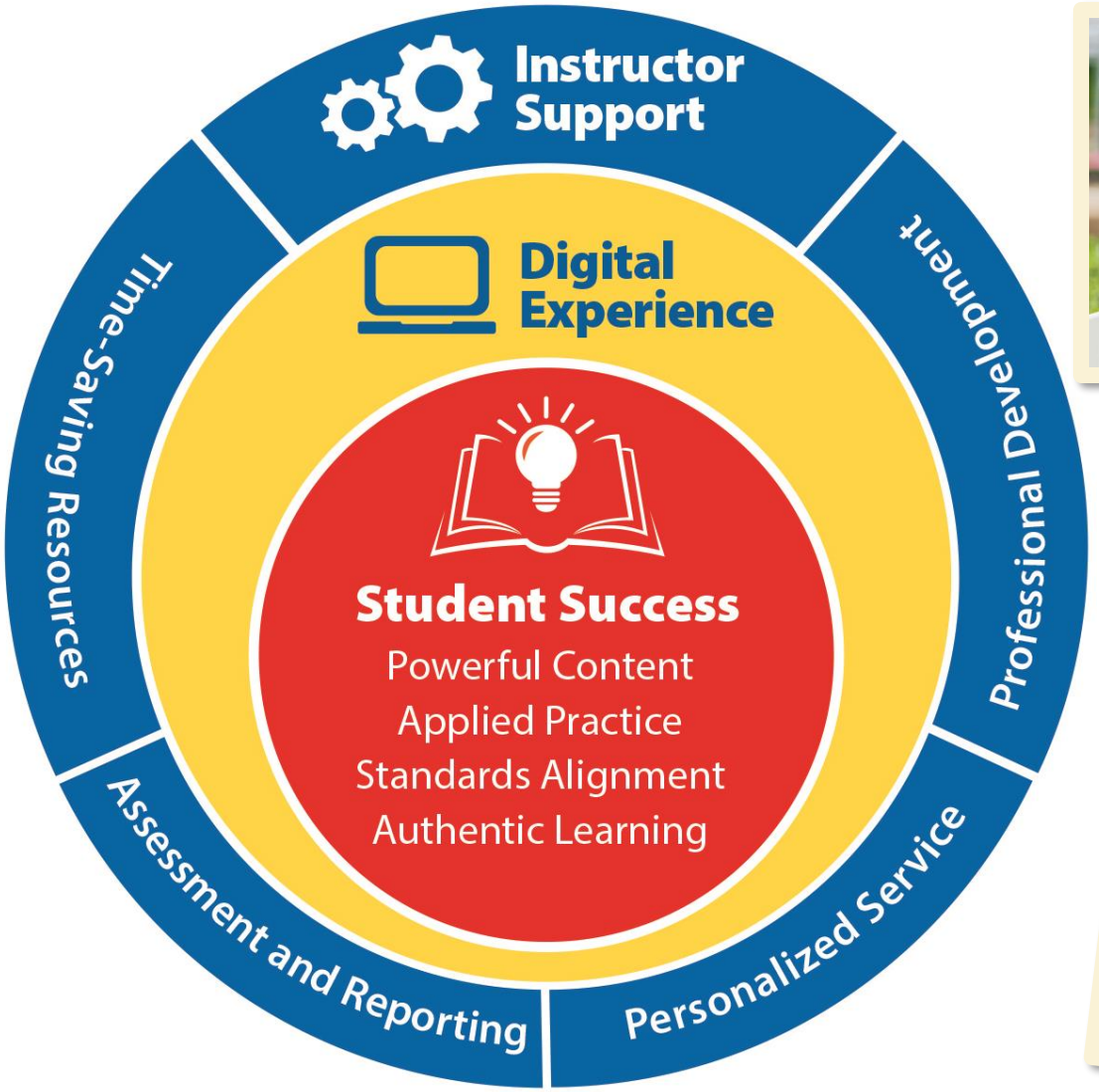

Student Success Is At the Heart of What We Do

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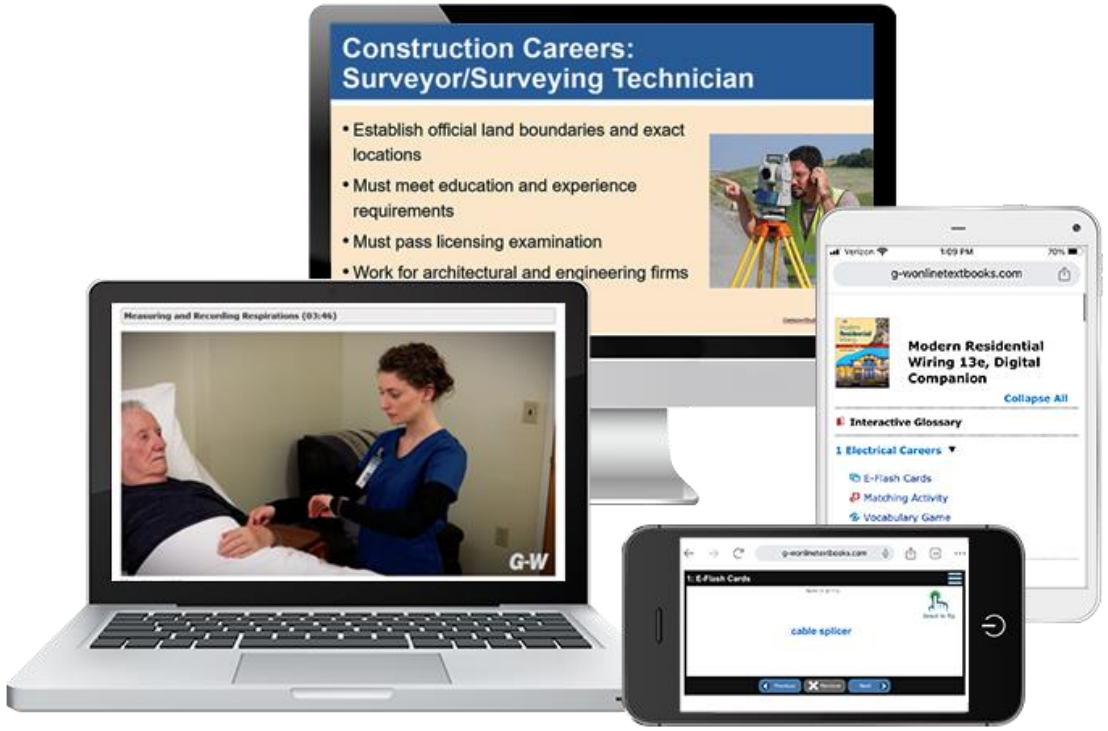

*Shown are examples across various titles

- ✓ Prepare for class
- ✓ Reinforce new concepts
- ✓ Assess learning

Ready-to-Implement Online Instructor Resources

Auto Engine Repair: Lesson Plan

Instructor: *Date:*
Course: *Unit:*

Chapter 1: Review of Engine Operation

Learning Outcomes

- 1.1 Explain the purpose of major engine parts and assemblies.
  - Section 1.1 Automotive Engine
- 1.2 Summarize the four-stroke cycle.
  - Section 1.2 Four-Stroke Cycle
- 1.3 Describe related systems of an engine.
  - Section 1.3 Major Automotive Systems
- 1.4 Summarize the operation of the drive train.
  - Section 1.4 Drive Train

Standards

The following ASE Education Foundation standards are addressed in this chapter:

- **ASE Education Foundation MLR Tasks**
  - A.1. Research vehicle service information such as fluid type, internal combustion engine operation, vehicle service history, service precautions, technical service bulletins, and recalls including vehicles equipped with advanced driver assistance systems (ADAS).
  - B.1. Identify
  - C.1. Identify
- **ASE Education Foun**
  - A.1. Res
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  - B.1. Identify
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- **ASE Education Foun**
  - N/A

Lesson Plans, PowerPoint Presentations, and Answer Keys

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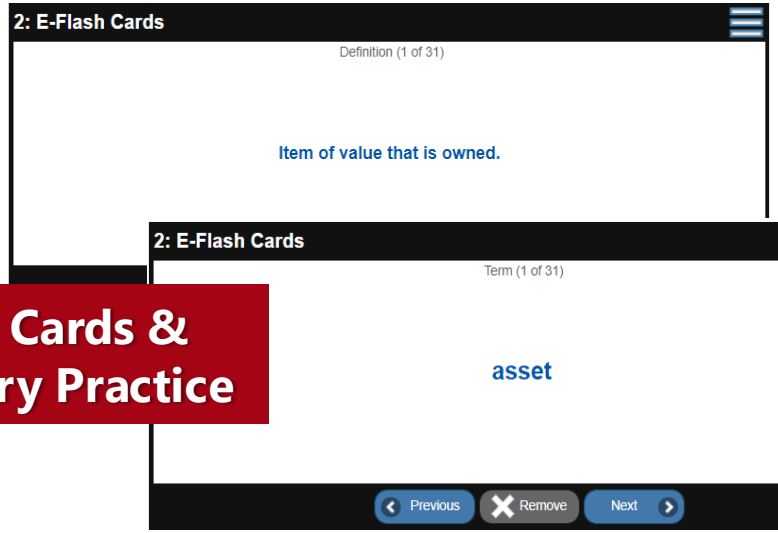
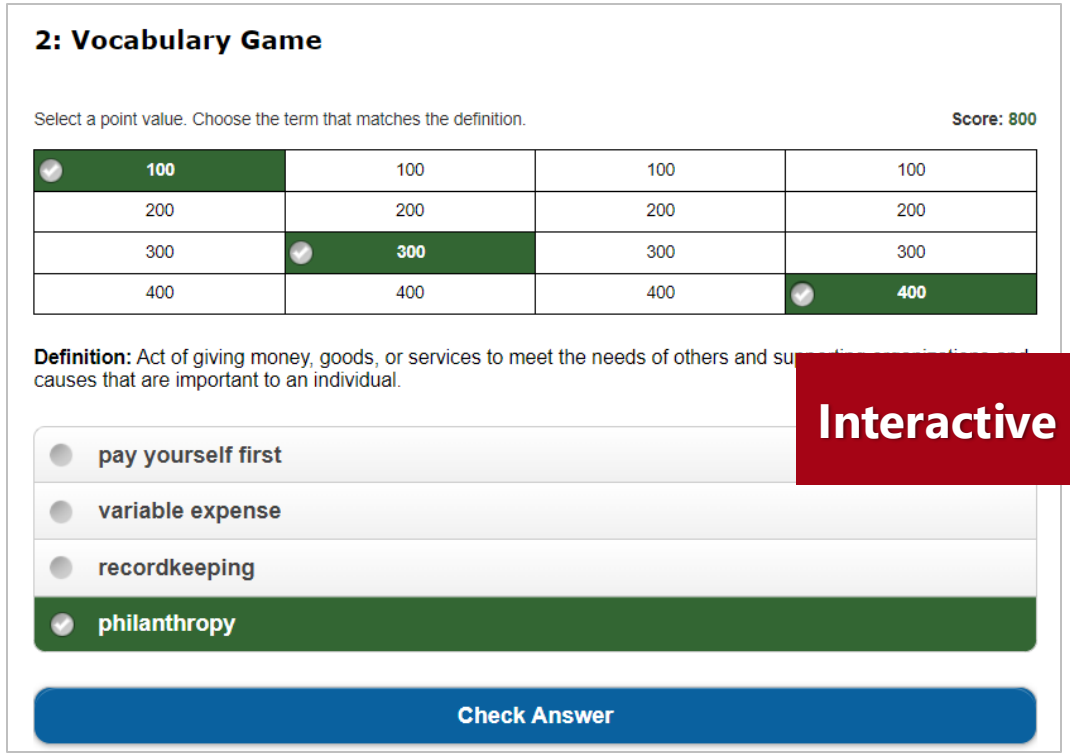
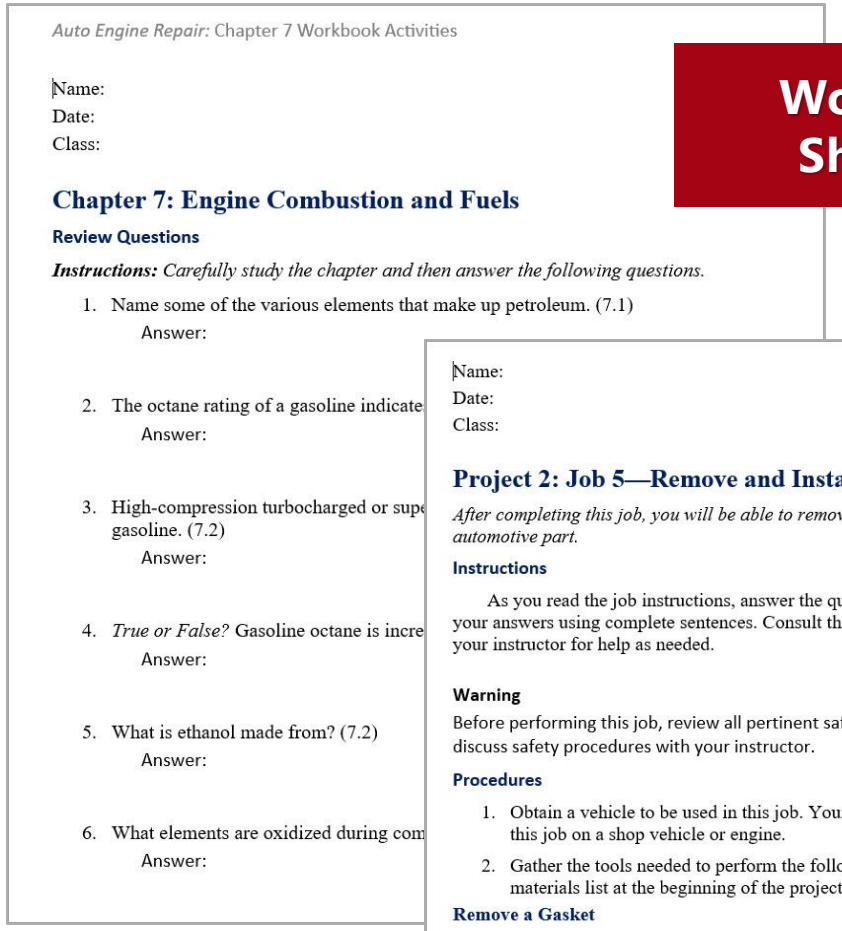


E-Flash Cards & Vocabulary Practice



Interactive Activities


Auto Engine Repair: Chapter 7 Workbook Activities

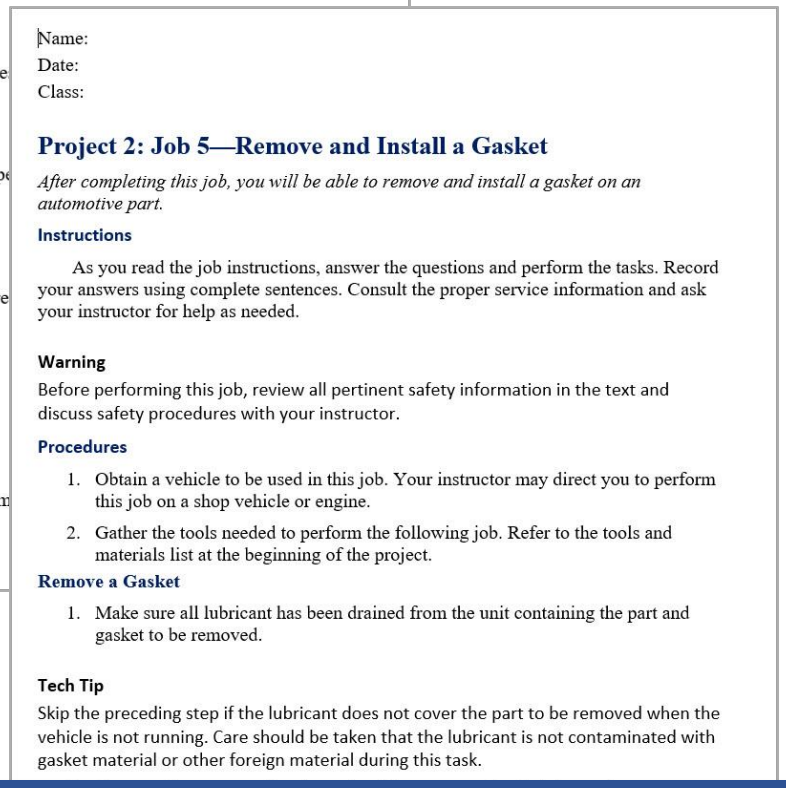
Name:
Date:
Class:

Chapter 7: Engine Combustion and Fuels

Review Questions

Instructions: *Carefully study the chapter and then answer the following questions.*

1. Name some of the various elements that make up petroleum. (7.1)
   Answer:
2. The octane rating of a gasoline indicate
   Answer:
3. High-compression turbocharged or supe gasoline. (7.2)
   Answer:
4. *True or False?* Gasoline octane is incre
   Answer:
5. What is ethanol made from? (7.2)
   Answer:
6. What elements are oxidized during com
   Answer:


Name:
Date:
Class:

Project 2: Job 5—Remove and Install a Gasket

After completing this job, you will be able to remove and install a gasket on an automotive part.

Instructions

As you read the job instructions, answer the questions and perform the tasks. Record your answers using complete sentences. Consult the proper service information and ask your instructor for help as needed.

Warning

Before performing this job, review all pertinent safety information in the text and discuss safety procedures with your instructor.

Procedures

1. Obtain a vehicle to be used in this job. Your instructor may direct you to perform this job on a shop vehicle or engine.
2. Gather the tools needed to perform the following job. Refer to the tools and materials list at the beginning of the project.

Remove a Gasket

1. Make sure all lubricant has been drained from the unit containing the part and gasket to be removed.

Tech Tip

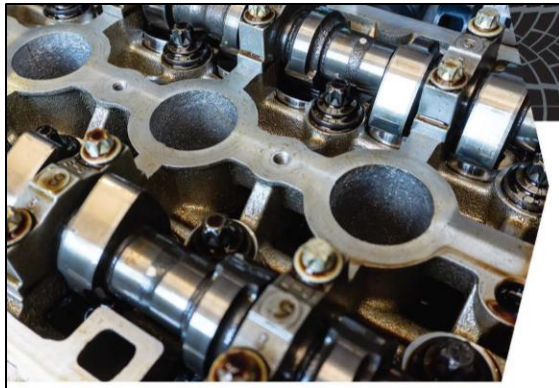
Skip the preceding step if the lubricant does not cover the part to be removed when the vehicle is not running. Care should be taken that the lubricant is not contaminated with gasket material or other foreign material during this task.

Workbook and Shop Manual

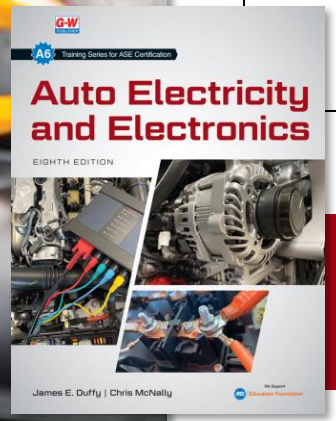
Integrate G-W Digital Student Resources

©2026, 8th edition, 514 pp.

by James E. Duffy and Brian Palmiter



Brief Contents



Student Textbook

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SHOP TALK

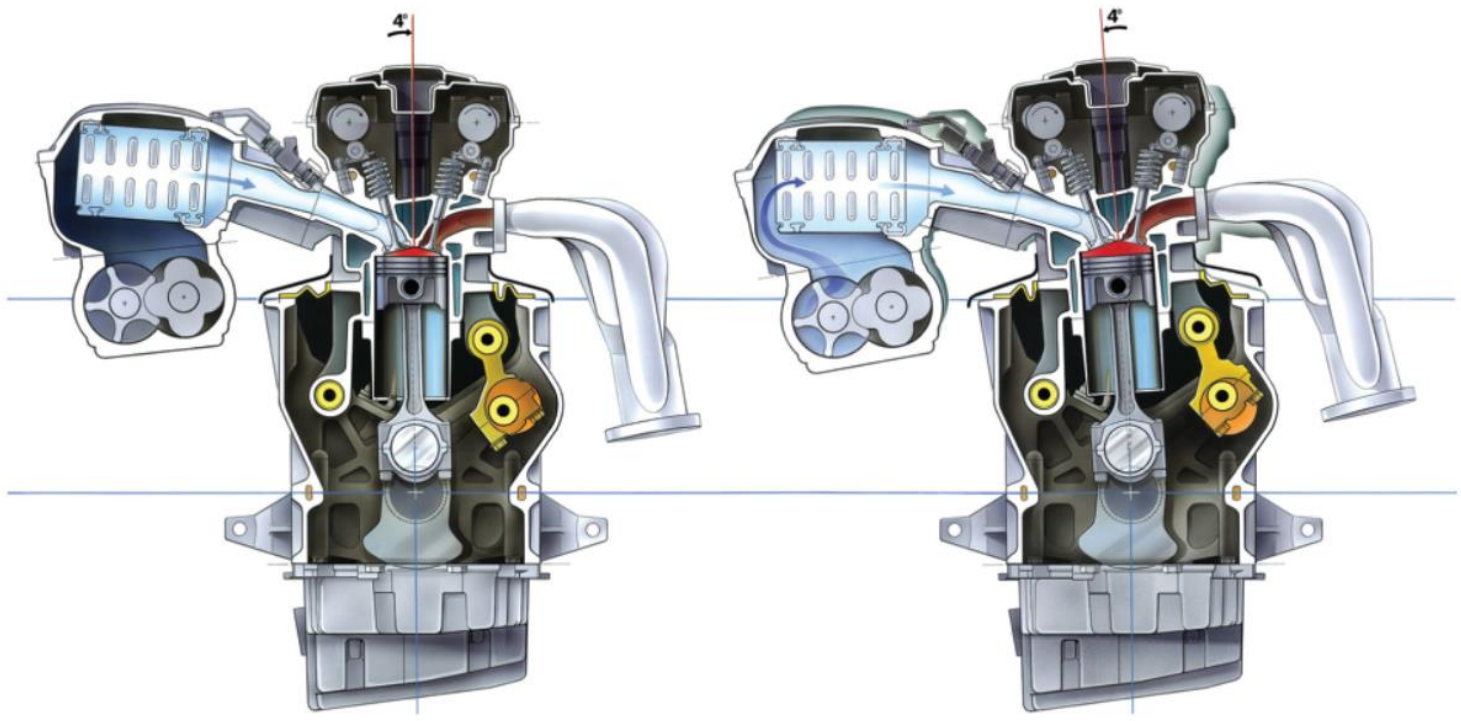
Welcome to a comprehensive exploration of the systems that power and control modern vehicles. In today's automotive repair world, understanding these systems is more crucial than ever because as vehicles become increasingly complex, you need to stay ahead of the curve to effectively diagnose and repair them. As you begin your exploration, you'll learn about the fundamental components of automotive systems, from ignition and fuel systems to emission control and drive trains. By gaining an understanding of these systems, you will be equipped with the knowledge and skills necessary to navigate the challenges of modern vehicle repair. So, let's dive in and uncover the inner workings of the engines that drive us forward.

Apply and Analyze

1. Explain how the arrangement and functions of the major components of a multicylinder engi valves, facilitate the four-stroke cycle and contribute to the overall operation and efficiency of explanation. (1.1)
2. Using the information provided about the valve train, camshaft timing, intake and exhaust ma a hypothetical modification or enhancement to optimize engine performance, fuel efficiency, c Consider the interplay between these components and how your modification would impact t for your design choices. (1.3)
3. Imagine you are tasked with designing an innovative emission control system for a modern ve described, including PCV, evaporative emissions control, EGR, air injection, and catalytic con types of emissions while also optimizing efficiency and minimizing environmental impact. Ex and discuss how it integrates with other vehicle systems to achieve its objectives. (1.3)

Critical Thinking

1. Reflecting on the information provided about the four-stroke cycle and the major component or technologies that could be implemented to improve the efficiency or performance of intern factors such as fuel consumption, emissions, and overall environmental impact in your respon
2. Evaluate the advantages and disadvantages of different methods of fuel injection, such as mu terms of their impact on engine performance, fuel efficiency, and emissions control. Consider distribution, and overall combustion efficiency in your analysis. Additionally, discuss how adv the future design and development of automotive engines. (1.3)
3. Evaluate the trade-offs between manual and automatic transmissions in terms of performanc costs. Considering advancements in transmission technology, discuss potential future develop these two transmission types and their implications for the automotive industry. (1.4)



ASE-Type Questions

1. Technician A says an engine's timing belt turns the camshaft at one-half of the engine speed. Technician B says the camshaft opens the exhaust valve at the beginning of the power stroke. Who is correct? (1.1, 1.2)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
2. Technician A says that gasoline direct injected systems use both an electric fuel pump and a high-pressure mechanical fu says that diesel injection systems inject fuel directly into the cylinder. Who is correct? (1.3)
   A. A only.

What's New to the Edition

ASE-Type Questions

1. Technician A says that a fire extinguisher bearing this symbol can be used on burning oil or gasoline. Technician B says that a fire extinguisher bearing this symbol can be used on an electrical fire. Who is correct? (2.1)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
2. Technician A says that you should disconnect the battery before removing a fuel line from an engine. Technician B says that you should wrap a shop towel around the fitting before disconnecting a fuel line. Who is correct? (2.1)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
3. Technician A says that a battery can produce gases that can cause an explosion. Technician B says that sodium-filled engine valves, if mishandled, can cause an explosion. Who is correct? (2.1)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
4. Technician A says that a respirator will block all poisonous fumes that can be produced in a shop. Technician B says that a respirator will block only those fumes for which it is rated. Who is correct? (2.3)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
5. Technician A says that battery acid can cause chemical burns to the skin. Technician B says that some decarbonizing cleaners can cause chemical burns to the skin. Who is correct? (2.1)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
6. Technician A says that an electric power tool with a faulty ground prong can cause electrocution. Technician B says that if a power tool's faulty ground prong is removed, the power tool is safe to use. Who is correct? (2.1)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
7. The most probable cause of physical injury in an auto shop is _____. (2.1)
   A. sunburn
   B. robbery
   C. strained backs
   D. None of the above.
8. Technician A says if debris or chemicals get into your eyes, you should flush them using an eyewash station. Technician B says that you should locate and learn how to use an eyewash station before you may need it. Who is correct? (2.3)
   A. A only.
   B. B only.
   C. Both A and B.
   D. Neither A nor B.
9. All of the following are safety rules to follow when working in an auto shop, *except*: (2.2)
   A. *never* carry sharp parts or tools in your pocket.
   B. *always* lift heavy engine parts with your back, *not* with your legs.
   C. keep the auto shop organized.
   D. *always* keep equipment guards or shields in place.
10. Technician A says that used motor oil is considered a hazardous waste. Technician B says that used antifreeze is considered a hazardous waste. Who is correct? (2.5)
    A. A only.
    B. B only.
    C. Both A and B.
    D. Neither A nor B.
11. Technician A says that refrigerants must be recovered and recycled. Technician B says that used antifreeze can be mixed with motor oil when being recycled. Who is correct? (2.5)
    A. A only.
    B. B only.
    C. Both A and B.
    D. Neither A nor B.

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ASE Education Foundation Task Lists

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CHAPTER 2

Shop Safety

LEARNING OUTCOMES

After studying this chapter, you should be able to:

2.1 List common types of accidents.
2.2 List safety rules.
2.3 Identify PPE that should be worn when performing various tasks in the shop.
2.4 Describe how to use lifts and other support equipment, such as jack stands.
2.5 Explain what qualifies a material as hazardous waste and describe the regulations concerning the disposal of hazardous wastes.
2.6 Explain precautions that must be taken when working on hybrid vehicles.

TECHNICAL TERMS

asphyxiation
corrosive hazard
electrical fires
electric shock
explosion
fire
hazardous waste
ignitable hazard
personal protective equipment (PPE)
reactivity hazard
respirator
safety data sheet (SDS)
toxicity hazard

SHOP TALK

Making safety a priority in our daily tasks as auto technicians is critical for our livelihood. We face potential hazards in our workspace that require constant vigilance. Using safe practices isn't just about protecting ourselves, but also our colleagues, customers, and reputation. You must prioritize safety by staying aware of your surroundings, using proper tools, and following proper procedures. Remember, the one time you get lazy and don't wear your safety glasses may be the time a bolt snaps or a tool shatters. *Never* become complacent and always make safety a guiding principle in everything you do, ensuring that every vehicle leaving the garage is not only fixed, but fixed safely.

Tech Tip

Organizing and implementing a productive plan of work involves creating a detailed schedule that prioritizes tasks

Chapter-Opening Materials

Warning

Air bag systems are often equipped with an energy reserve module, which can deploy the air bag even after power is disconnected. The energy reserve module must be disconnected or allowed to discharge for up to 30 minutes after disconnecting the battery. Refer to the service manual for details.

Caution

If a customer requests spark plug hole thread repairs with the cylinder head on the engine, coat the drill bit and tap with grease. This will help hold the metal shavings onto the drill and tap. However, avoid repairing spark plug hole threads with the cylinder head installed. The metal shavings from drilling and tapping could fall into the cylinder. These shavings can score the cylinder wall or stick on the valve faces, causing engine damage. Warn the customer of the dangers of this procedure and get the customer's approval in writing.

Tech Tip

A drill and tap size chart is located in the *appendices* in the back of this text. This chart will help you select the correct size of drill bit for a given tap size. For example, a 27/64″ hole must be drilled when using a 1/2″ coarse tap.

Special Features

Chapter 2 Review and Assessment

SUMMARY

- Six types of accidents that may occur in a shop are fires, explosions, chemical burns, electric shocks, asphyxiation, and other physical injuries. Constantly think about what you are doing and take corrective action when needed. (2.1)
- Automotive repair shop safety rules include organization, cleanliness, using proper tools, lifting safely, maintaining lighting and ventilation, avoiding asbestos exposure, and following correct procedures for airbag and hydraulic systems. (2.2)
- The proper personal protective equipment must be worn when performing tasks that could be hazardous to your health and safety. (2.3)
- You must learn and apply the proper procedures when using floor jacks and lifts. You must know how the vehicle weight is distributed, position the lift saddles properly, and securely engage the lift safety lock. (2.4)
- Hazardous waste is often generated in the service facility. This waste is regulated by the Resource Conservation and Recovery Act and must be disposed of properly. (2.5)
- A material safety data sheet provides information about a chemical or substance, such as common reactions and treatments for overexposure. (2.5)
- Hybrid vehicles generate extreme electrical energy. Therefore, specific safety rules have been developed that must be followed during servicing. These rules address how to tow the vehicle, how to disconnect power supplies, and what clothing to wear to increase safety. (2.6)

REVIEW QUESTIONS

Answer the following questions using the information provided in this chapter.

Know and Understand

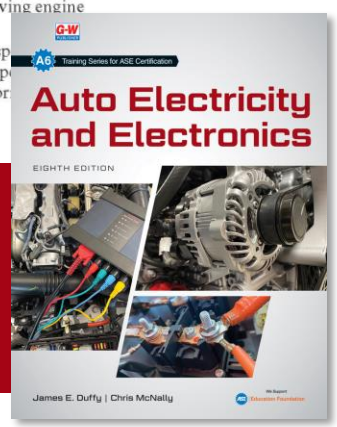
1. Which is *not* one of the six common types of accidents? (2.1)
   A. Explosions.
   B. Chemical burns.
   C. Viruses.
   D. Electric shock.
2. *True or False?* Gasoline is the most dangerous
3. When working around gasoline, which of the following steps should you take? (2.1)
   A. Keep sources of heat away from the engine's fuel system.
   B. Allow spilled fuel to evaporate.
   C. Retain the battery connection for testing purposes.
   D. Use oil absorbent on spilled fuel.
4. Batteries generate what kind of explosive gas due to the chemical reaction inside? (2.1)
   A. Hydrogen.
   B. Oxygen.
   C. Methane.
   D. Acetylene.
5. Which is a condition in which the body has too little oxygen or too much carbon dioxide? (2.1)
   A. Hypothermia.
   B. Asphyxiation.
   C. Shock.
   D. Physical injury.
6. What gas found in automotive exhaust is considered a deadly poison? (2.1)
   A. Cyanide.
   B. Mercury.
   C. Carbon monoxide.
   D. Strychnine.
7. Electrical short circuits can be prevented by using _____. (2.1)
   A. a heavy gauge extension cord
   B. no more than one piece of equipment per electrical outlet
   C. a voltage converter to change voltage from AC to DC
   D. the ground prong on equipment cords
8. *True or False?* It is acceptable practice to remove the ground prong from equipment cords to use them in older outlets. (2.1)
9. *True or False?* Jewelry should not be worn when on the job because it can get caught in moving engine parts and cause injury. (2.2)
10. *True or False?* It is each individual's resp to ensure that they are wearing the prop and equipment for each task they perfor
11. Which of the following is *not* a precaution when using an automotive lift? (2.4)
    A. Position the lift saddles so they securely contact the vehicle's chassis.
    B. Lower a vehicle slowly.
    C. Carefully push down on one end of the vehicle to see if it moves or feels unstable.
    D. Do not engage the vehicle safety locks before working under it.
12. To which of the following does the Resource Conservation and Recovery Act apply? (2.5)
    A. Businesses that generate, transport, or manage hazardous waste.
    B. Businesses that maintain or repa privately owned vehicles.
    C. Businesses that maintain or repair h equipment and farm equipment.
    D. All are correct.
13. Which of the following should be done when towing a hybrid vehicle? (2.6)
    A. Ensure the ignition key is in the on position.
    B. Roll down the driver's window so the vehicle can be steered.
    C. Raise the drive wheels to prevent the motor-generator from engaging.
    D. Remove the fuse that powers the airbag system.
14. When working on a hybrid, _____.
    A. keep potential conductors away from the vehicle
    B. avoid touching high voltage and any conductor
    C. create a buffer zone of about 3' (1 m) around the vehicle's perimeter
    D. All are correct.

Apply and Analyze

1. How can technicians effectively apply the general safety rules outlined in an automotive repair shop to prevent accidents such as fires, explosions, asphyxiation, chemical burns, electric shock, and physical injuries? What measures should they take to ensure their safety and that of others while working in such an environment? (2.2)
2. How should technicians effectively use PPE such as eye protection, hearing protection, respiratory protection, and skin protection? What precautions should they take when using lifting equipment such as floor jacks and vehicle lifts to ensure their safety and prevent accidents or injuries in a repair shop environment? (2.3, 2.4)
3. How can a service facility effectively manage and dispose of hazardous waste in compliance with federal regulations? What strategies can be implemented to minimize the generation of hazardous waste, promote recycling, and ensure the safe handling and transportation of these materials, thereby reducing environmental impact and maintaining regulatory compliance? (2.5)

Critical Thinking

1. How do the specific safety protocols outlined for preventing accidents such as fires, explosions, asphyxiation, chemical burns, electric shock, and physical injuries in a repair shop underscore the importance of meticulous attention to detail and comprehensive understanding of potential hazards? How might failure to adhere to these protocols impact both personal safety and the safety of others in the workshop environment? (2.2)
2. How might the conscientious use of PPE and adherence to safety protocols when operating lifting equipment not only safeguard the technician's well-being but also contribute to the overall efficiency and professionalism of the work environment? What potential consequences could arise from neglecting these safety measures? (2.3, 2.4)
3. How might the implementation of strict safety protocols, such as the proper disposal of hazardous waste and the use of personal protective equipment, not only ensure compliance with regulations but also contribute to the overall sustainability and reputation of an automotive service facility, thereby enhancing its long-term success and minimizing environmental impact? (2.2, 2.3, 2.4, 2.5)



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End-of-Chapter Content

Name:
Date:
Class:

Project 2: Job 5—Remove and Install a Gasket

After completing this job, you will be able to remove and install a gasket on an automotive part.

Instructions

As you read the job instructions, answer the questions and perform the tasks. Record your answers using complete sentences. Consult the proper ser
your instructor for help as needed.

Warning

Before performing this job, review all pertinent safety informa
discuss safety procedures with your instructor.

Procedures

1. Obtain a vehicle to be used in this job. Your instructor
this job on a shop vehicle or engine.
2. Gather the tools needed to perform the following job. R
materials list at the beginning of the project.

Remove a Gasket

1. Make sure all lubricant has been drained from the unit
gasket to be removed.

Tech Tip

Skip the preceding step if the lubricant does not cover the par
vehicle is not running. Care should be taken that the lubricant
gasket material or other foreign material during this task.

2. Remove the part covering the gasket. You may need to
Be very careful not to damage the sealing surfaces.
3. Scrape all old gasket material from both sealing surface
4. Thoroughly clean the removed part and remove any gas
ebris on the related components in the vehicle.

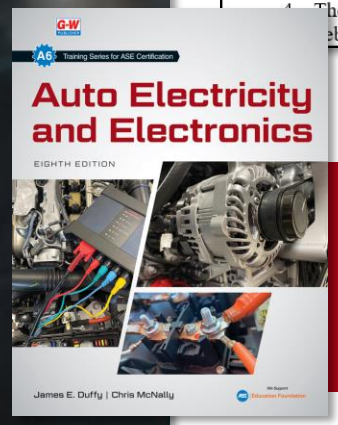
Name:
Date:
Class:

Chapter 7: Engine Combustion and Fuels

Review Questions

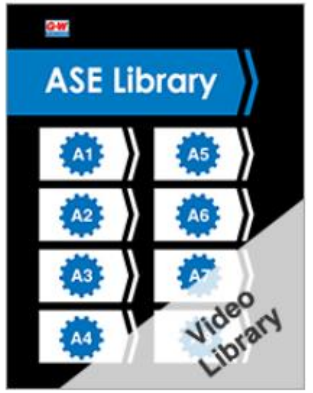
Instructions: *Carefully study the chapter and then answer the following questions.*

1. Name some of the various elements that make up petroleum. (7.1)
   Answer:
2. The octane rating of a gasoline indicates its ability to resist _____, or _____. (7.2)
   Answer:
3. High-compression turbocharged or supercharged engines normally require _____ gasoline. (7.2)
   Answer:
4. *True or False?* Gasoline octane is increased when alcohol is added. (7.2)
   Answer:
5. What is ethanol made from? (7.2)
   Answer:



Workbook and Shop Manual

Auto Engine Repair 8e, Image Library

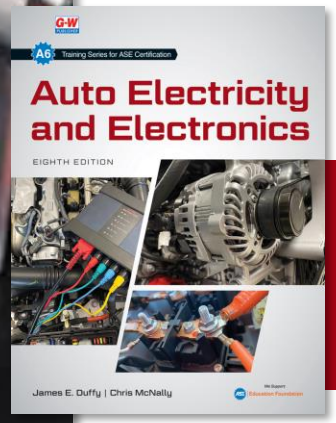


ASE Series Video Library

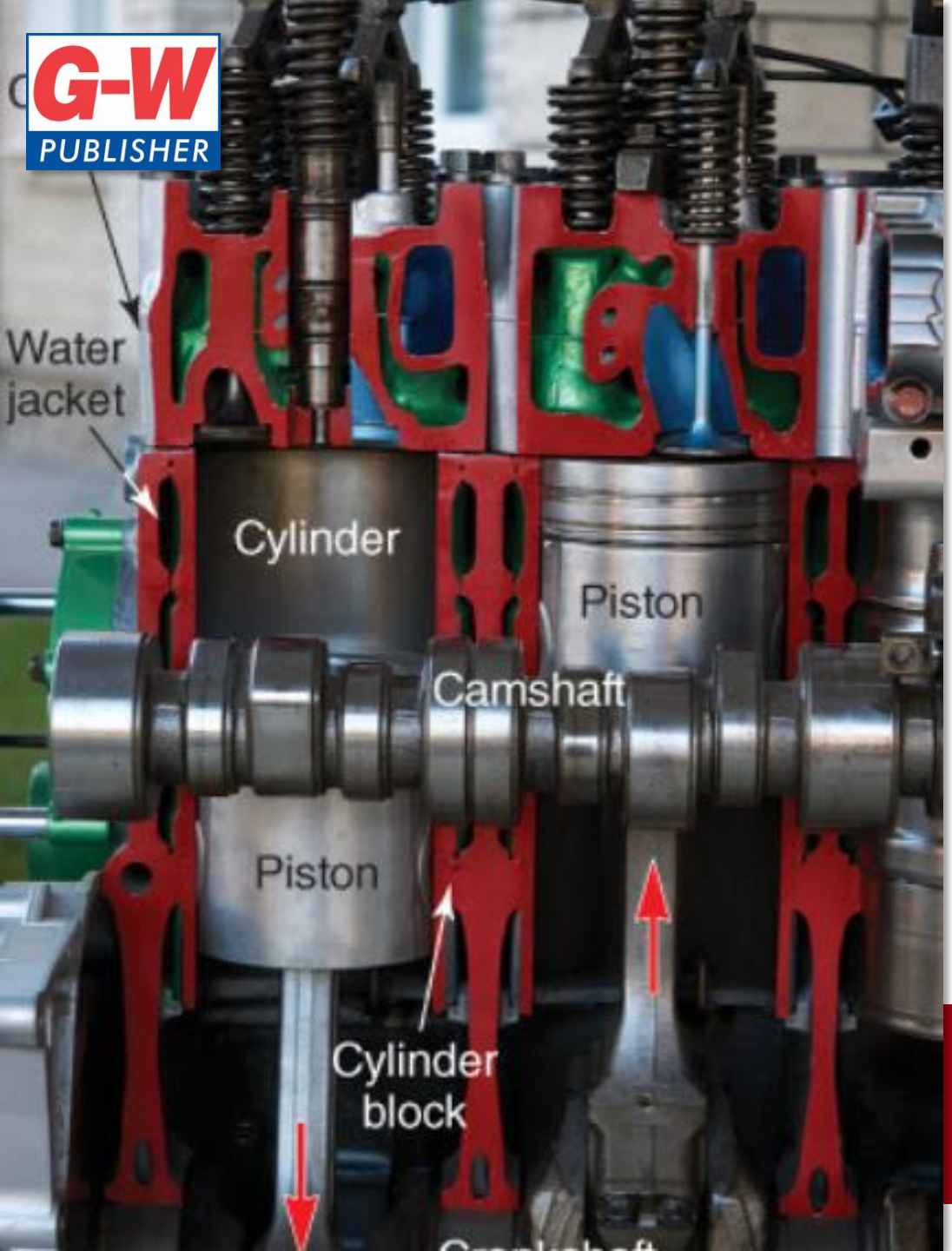
Auto Engine Repair 8e, Digital Companion

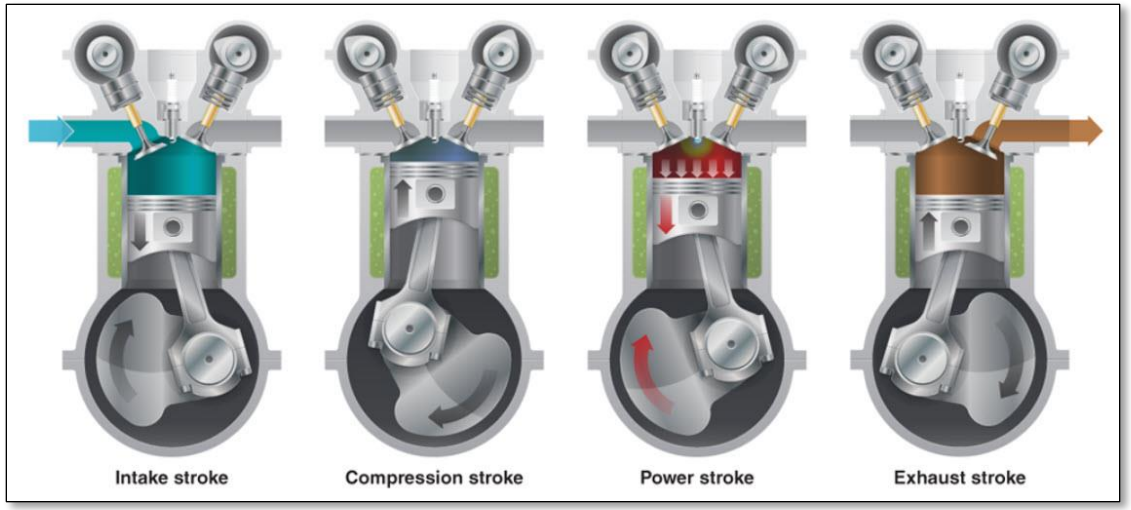
Automotive Virtual Toolbox

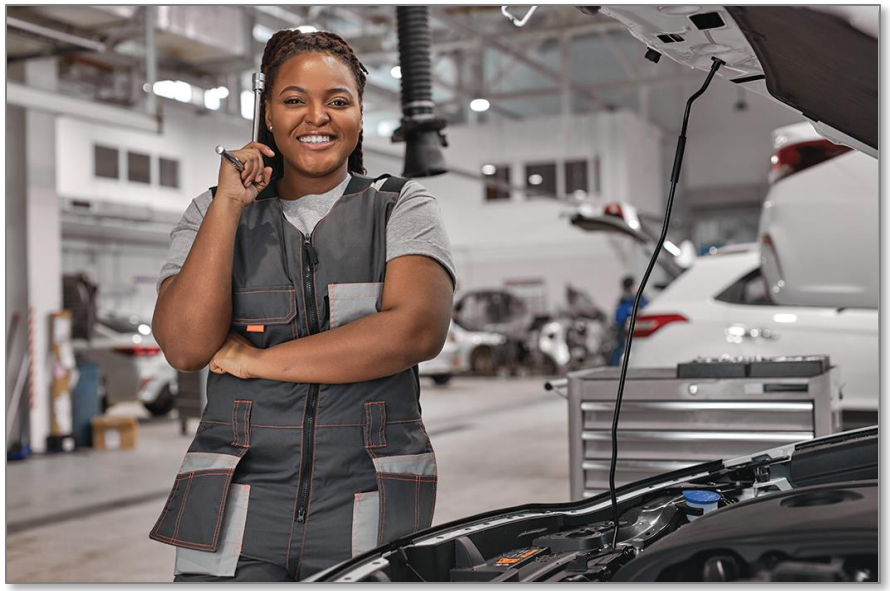
Multimeter Simulations



Digital Assets







Images and Illustrations

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Auto Heating and Air Conditioning E-Flash Cards

Term (3 of 5)

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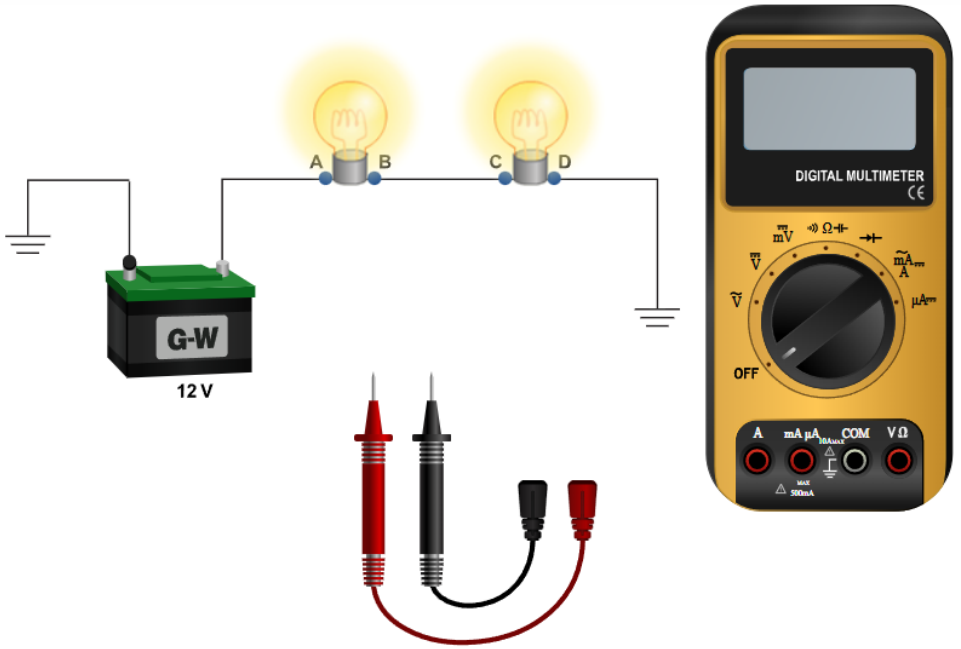
Previous | Remove | Next

Measuring Resistance in a Series Circuit: Problem 1

Battery
- Connected
- Disconnected

Multimeter Red Lead
- A
- mAμA
- VΩ
- Disconnected

Multimeter Black Lead
- COM
- Disconnected



Multimeter Setting: OFF

Multimeter Red Probe: Disconnected

Multimeter Black Probe: Disconnected

Virtual Toolbox and Simulations

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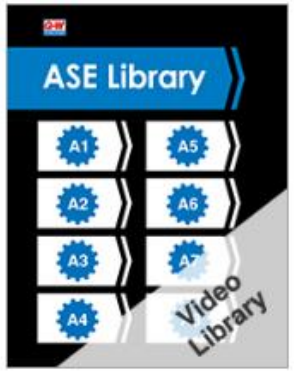


Video Library

A1 - Auto Engine Repair

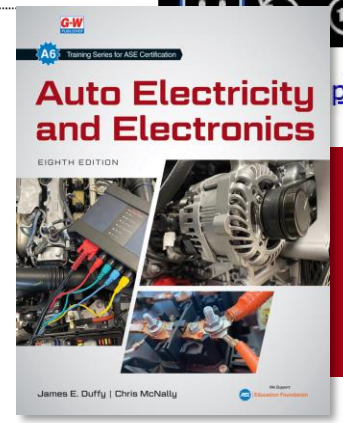
- Adjusting Valves (03:12)
- Instrument Panel Warning Indicators (01:59)
- Timing Belt Service (02:56)
- Fastener and Thread Repair (02:55)
- Cooling System Service (01:34)
- Performing an Oil and Filter Change (02:59)
- Hybrid Vehicle Engine Service Precautions (02:12)
- Engine Cylinder Leakage Test (02:04)
- Powertrain Mount Service (01:24)
- Cooling System Inspection and Testing (03:14)

A2 - Automatic Transmissions and Transaxles

- Checking Automatic Transmission Fluid (02:19)
- Automatic Transmission External Inspection (02:34)
- Automatic Transmission Fluid Service (03:05)
- CVT and Hybrid Transmissions (02:09)

Using Electrical Test Equipment

pt



ASE Video Library

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Home Favorite History New Narrated Goodheart-Willcox

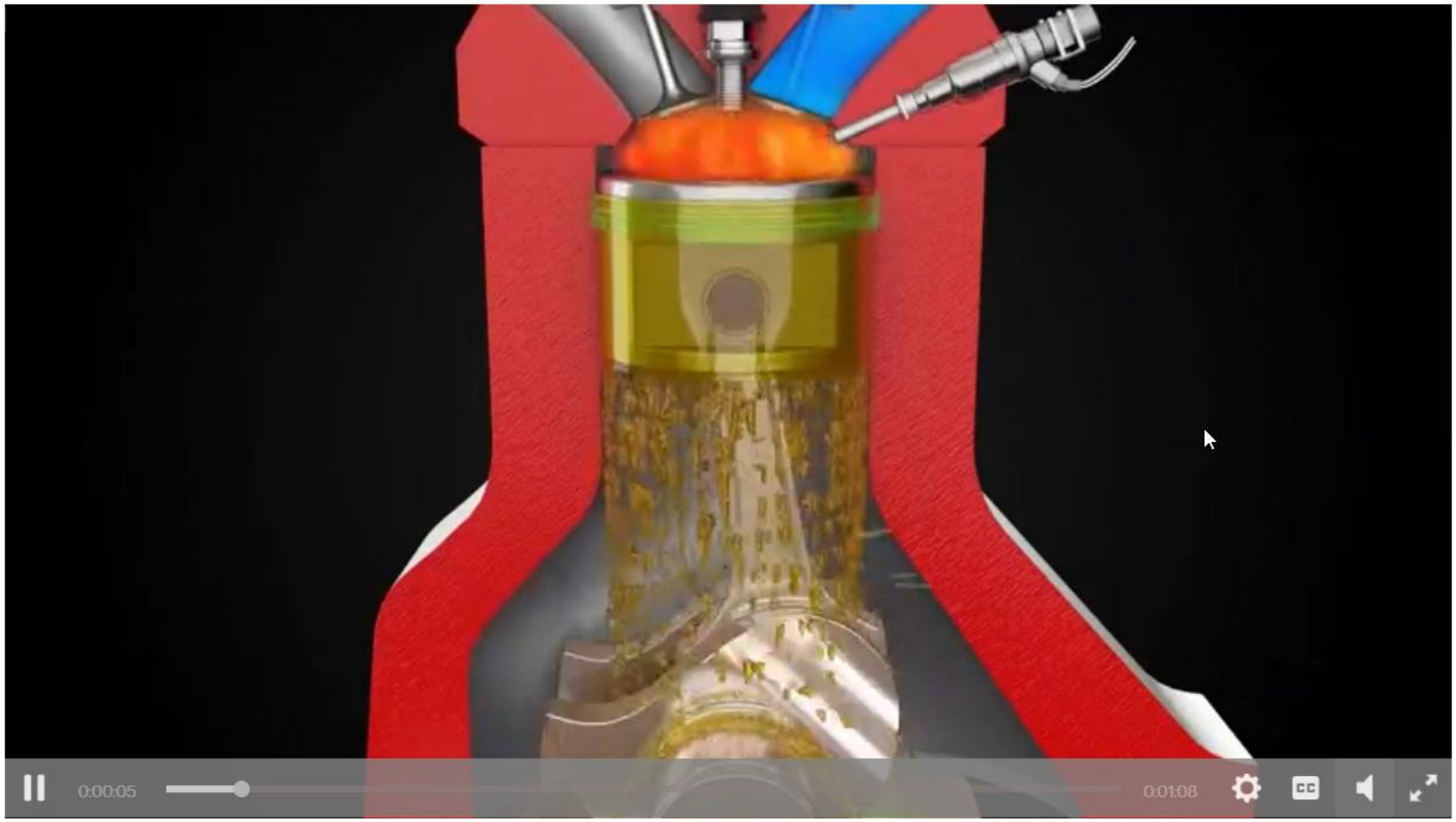
INTERACTIVE VIDEOS


Engine


Engine Oil System


Timing Belt


Timing Chain



NARRATED VIDEOS


Engine Oil S... 01:54


Timing Belt 01:17


Timing Chain

Engine

Basic Description

Internal combustion engines co
pistons, a crankshaft, and valve

MotoVisuals from Advance Auto Parts

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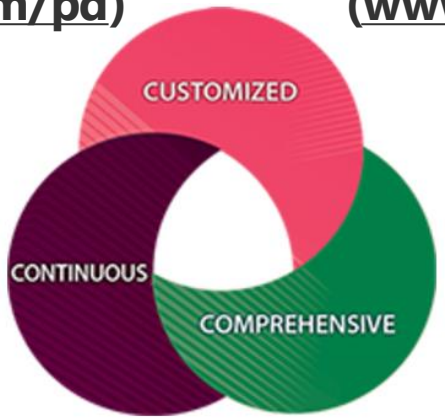

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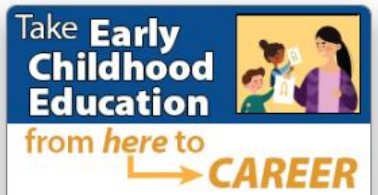

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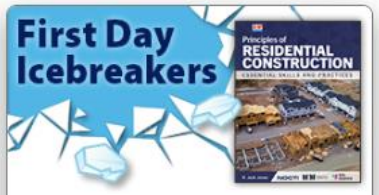

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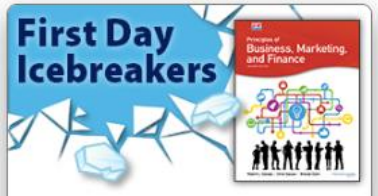

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