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# Introduction to Diesel Truck Mechanics

## INTRODUCTION

### The Diesel Engine Service Technician Career

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The next time you're in a supermarket or a department store, take a few extra minutes to walk down one or two aisles while looking at the range of products on display. Have you ever wondered about the route all those products (as well as the rest of the items in the store) followed to get there? It's a safe bet that every item for sale in the store spent some time being transported by a diesel-engine-powered vehicle. In fact, many of the products on the shelf, as well as the raw materials that were used to produce the products, were transported by more than one diesel-engine-powered vehicle. That's because trucks, trains, or ships almost always move *freight*, which is a name given to transported products. Almost all freight-carrying trucks, trains, and ships are powered by diesel engines.

The U.S. Federal Highway Administration estimates that 2.4 million diesel-powered trucks with five or more axles (like the one in Figure 1) log over 99 billion miles in the United States each year. Further, consider that these trucks make up only a little more than one-quarter of the 26.4 million commercial trucks in the United States (the majority of which are diesel powered). All those vehicles, traveling so many miles, demand lots of service and repair. The skilled technicians who make a living servicing these vehicles are known as *diesel engine service technicians*. And they service much more than just engines. Most diesel engine service technicians work on a



**FIGURE 1—Diesel-engine-powered vehicles like this one are responsible for moving most of the goods we purchase.**

wide range of systems found on *diesel-engine-powered vehicles* including electrical components, control computers, brakes, and steering systems.

Since the freight-transporting vehicles (like trucks, trains, and barges) are expensive to buy, and the goods they carry are often valuable and in immediate demand, the freight-transporting industry depends on vehicles that operate reliably, safely, and on time. For the industry to achieve this goal, it must make vehicle maintenance a high priority, and it does so by hiring well-trained technicians, paying them well, and

encouraging them to advance their skills through on-going training programs! These factors are part of what makes a career as a diesel engine service technician challenging, interesting, and very well paid.

The diesel-engine-powered vehicle repair field is not only big, it's continually growing. It provides an opportunity to earn a good income and offers many chances for personal advancement. You can work at this trade in any area, 365 days a year—there are no seasonal or regional restrictions on the job. Professional technicians enjoy benefits of job security, interesting work, ongoing training, and a wide variety of employment opportunities. If you enjoy fixing things, working with your hands, and mastering new technologies, you'll find personal satisfaction in repairing vehicles on which others depend.

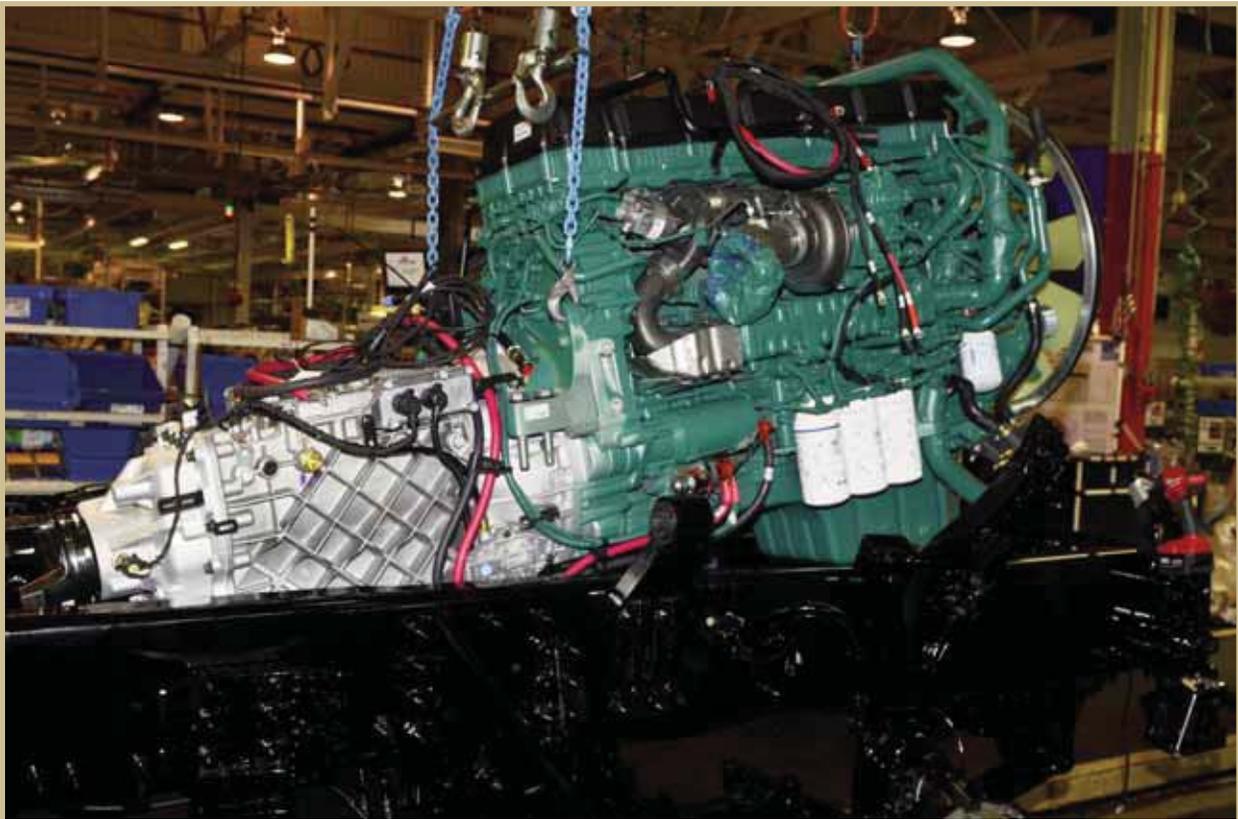
## Where Diesel Engine Service Technicians Work

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Most of us own or have owned a car, most of them equipped with a gasoline engine. Gasoline-powered automotive engines and diesel-fuel-powered engines like the one in Figure 2 are both *internal-combustion engines* (more about this term later), but there are several differences between these two engine types. You're probably aware that one of the things that makes a diesel engine different from the gasoline version is the type of fuel it burns. However, as you'll learn later in your program, the differences don't stop there. The way in which a diesel engine operates is also different. This difference is part of what dictates where diesel engines are used and, therefore, where diesel engine service technicians work.

There are three distinct benefits of the diesel engine when compared to a gasoline-fueled engine. Diesel engines offer more hauling power for comparably sized engines, longer engine life, and better fuel economy.

The benefits of diesel engines make them ideal to power large freight-carrying trucks commonly referred to as *tractor-trailers*, *18-wheelers*, or *over-the-road trucks*. As you've certainly noticed when driving past these vehicles, they contain two major parts—the *truck* or *tractor*, which contains the diesel



**FIGURE 2—Diesel engines like this one power an incredibly wide range of vehicles including large trucks, construction equipment, ships, and some pickup trucks.**

engine and most other complicated systems, and the *trailer*, which carries the freight. Both of these parts will be discussed throughout your program. However, most of your program's content will apply specifically to trucks or tractors. Parts of your program also discuss trailer lighting, brakes, and other trailer systems. As you'll soon learn, even though the job title *diesel engine service technician* refers specifically to engines, nearly all technicians work on many or all other vehicle systems, including brakes, steering, suspension, and trailers. These vehicles log many more miles per year than most of our cars and haul tremendous loads with great reliability. Of course, the high demands placed on these vehicles translate into the need for an equally high level of maintenance. Vehicle safety and operating reliability are directly affected by the diesel engine technician.

Diesel engines aren't just used to power large freight-carrying trucks. They also power buses, ships, locomotives, emergency generators, and heavy construction equipment like cranes, dump trucks, and earth movers (Figure 3). A fair number of *light trucks* (as pickup trucks are actually



**FIGURE 3—Heavy equipment like this dump truck depends on the high power delivered by a large diesel engine.**

classified) are equipped with diesel engines, as are a few types of passenger cars. In fact, where fuel prices are high, as in Europe, diesel-powered passenger cars are much more popular. While much of the material in your program relates specifically to freight-carrying trucks, information related to trucks' electrical, computer-control, braking, steering, and suspension systems still applies to the equipment found in most of these other vehicles.

Because diesel engines are used to power such a broad range of vehicles and other equipment, diesel engine technicians work in an equally broad range of environments. Most technicians in this field service over-the-road trucks. They often work for independent truck garages and dealerships that service and sometimes sell trucks to a variety of owner-operators (those who own and drive a truck), smaller companies that haul freight, and other businesses with a relatively small fleet of trucks.

A roughly equal number of technicians work for *long-haul* (long distance) freight-transport and local-delivery trucking companies. Depending on the trucking company and the type of business they accept, a fully loaded trailer or a portion of a trailer load (known as a less-than-full load) will be picked up from one location and eventually delivered to another. These trucking operations are typically organized around several terminals where freight might be removed from one truck and added to another vehicle that's routed to a specific location. Eventually, all freight will be delivered to a destination and all trucks pass through terminals like the one in Figure 4. At these terminals, diesel engine service technicians are responsible for servicing and inspecting the vehicles. As you'll learn later in this unit, the size and capabilities of the garage located at a terminal will greatly affect the type of work performed by the technicians working there.

Diesel engine service technicians can also be found working for all levels of government organizations servicing buses and other public-transport vehicles, fire trucks and other emergency vehicles, and maintenance equipment like trash- and snow-removal trucks. Private bus companies also employ many technicians, as do construction companies with heavy excavating or construction equipment that requires service.



**FIGURE 4—**Many vehicle service technicians employed by large freight hauling companies go to work in terminals like this where trucks are serviced, repaired, and loaded before being dispatched.

## Your Educational Goals

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Students take this program for a variety of reasons according to each person's individual goals. What are your educational goals, and how can our program help you reach them?

Perhaps you've just finished high school and are considering a career in diesel engine repair. Or maybe you're a professional who already works in another field, and you're interested in a career change. Either way, we believe that you'll find this program both informative and useful. This program is designed to fit the needs of both beginners and more advanced students. The topics are approached in a step-by-step manner, so you can learn correctly from the beginning without feeling overwhelmed. You'll also learn about the many career opportunities in the diesel engine servicing profession and how you can seize one of those opportunities for yourself.

If you're already employed in a related field, you may be interested in upgrading your skills or in obtaining professional certification. Maybe you feel that you need to brush up on the theory of vehicle operations, update your knowledge of the latest computer systems, or learn about new engine-management systems. Perhaps you'd just like to have a professional diploma that will prove your skills to your employer. If you're one of

these people, this program will help you to fine-tune the skills you already have. The information is presented in an easy-to-understand format but is also designed to be interesting to the intermediate or more advanced student. You'll learn lots of practical, professional tips that can help you do your job better, so you'll never be bored. This program is also an excellent tool to help you prepare to successfully pass a professional certification exam, such as the *Automotive Service Excellence (ASE)* exam. (You'll study certification examinations in more detail later in the study unit.)

If you work on cars, trucks, or engines for your own enjoyment, perhaps you'd like to take your hobby one step further and turn it into your career. Imagine being able to earn money doing something that you enjoy! For many people, it's a life-long dream to work at a job they truly love. If this is your dream, you've already taken the first step toward making it come true by enrolling in this program.

Maybe you're an owner-operator and you'd like to do a better job of maintaining and repairing your own truck or other diesel-powered vehicle. How much money do you think you could save in a year by doing repairs yourself? Even if you don't want to do all your own repairs, you'll be able to make sure that repair shops you hire are doing their job properly, without overcharging you. A strong knowledge of engine and vehicle repair can also make you feel safer and more confident when vehicle emergencies occur far from home. Many emergency problems can be solved quickly and easily without calling for help, if you have the know-how. Compare the cost of this program to the cost of towing, expensive roadside repairs, and vehicle downtime, and you'll see how quickly your learning can pay for itself.

This practical program is designed to teach you all the basic knowledge and skills you'll need to start working as a professional technician. The program topics are all presented in an interesting, easy-to-understand, and enjoyable format, with plenty of photos, diagrams, and other illustrations to enhance your learning. You'll learn through step-by-step instruction that takes you from the basics of engine operation to the latest high-tech repair techniques. You'll learn to study and interpret technical information and diagrams like the ones working technicians encounter every day (Figure 5). You can



**WARNING**

A BAR PIN SHIM MUST BE INSTALLED AT EACH BOLT LOCATION. THE SAME PART NUMBER SHIM IN THE SAME ORIENTATION MUST BE USED AT BOTH BOLT LOCATIONS ON ANY ONE END BUSHING. DO NOT INSTALL OR STACK MORE THAN ONE SHIM AT EACH BOLT LOCATION. USE GENUINE HENDRICKSON BAR PIN SHIMS, DO NOT USE STANDARD WASHERS. FAILURE TO FOLLOW THESE WARNINGS MAY RESULT IN IMPROPER VEHICLE ALIGNMENT, FRACTURE OF THE AXLE BRACKET OR BAR PIN WHICH COULD RESULT IN THE LOSS OF VEHICLE CONTROL AND POSSIBLE PERSONAL INJURY OR PROPERTY DAMAGE.

**ALIGNMENT ADJUSTMENT**

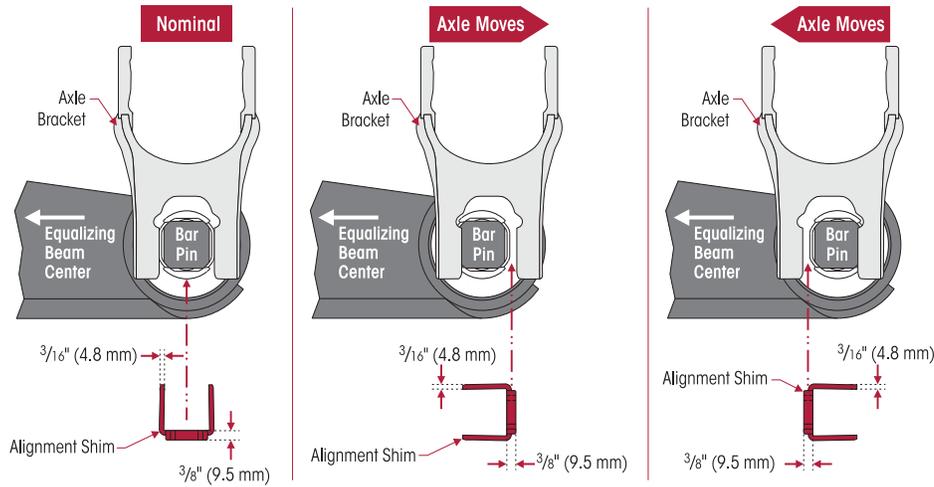
If alignment of the drive axles is required, as determined by an alignment inspection procedure the following steps will need to be performed.

1. Determine direction of axle thrust angle. Figure 7-7 illustrates the forward drive axle with a thrust angle to the left (-negative thrust).

**SERVICE HINT**

Axle movement is in the same direction as the increased shim thickness, see Figure 7-6.

FIGURE 7-6

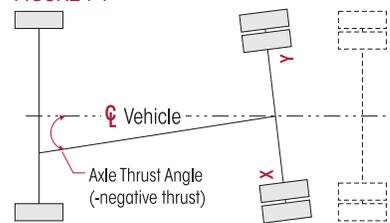


2. To determine where to adjust shim thickness use measurement **A** and **B** for front drive axle or **C** and **D** for rear drive axle, see Figure 7-4.

**SERVICE HINT**

Axle adjustment will be on the side of the bar pin where shim thickness is increased. For example, to correct the axle thrust angle illustrated in Figure 7-7, shim thickness will need to be increased at the front of the bar pin (Location X) and/or the rear of the bar pin (Location Y).

FIGURE 7-7



**NOTE**

Computerized alignment equipment, such as a Hunter WT100 series, is the preferred method of alignment. Laser alignment equipment may be used, however, to calculate the shim thickness required the target offset must be converted to thrust angle, see alignment equipment manufacturer for procedures.

3. Chock the wheels of the front axles to prevent vehicle movement during service.

**FIGURE 5—Working technicians are often required to interpret and work with technical publications and diagrams like these instructions for the alignment of a drive axle.** (Image courtesy of Hendrickson)

study at any time that fits your schedule, and at the pace that fits your needs (as fast or slow as you wish). You'll have all the benefits of professional instruction and training with none of the hassles of a formal classroom. You can start using your new skills right away, either by making repairs on your own vehicle or by obtaining employment in the diesel engine service field. You'll quickly get the most out of your investment in training. We're confident that no matter what your educational goals are, this training program can help you meet them successfully.

## What Will I Learn?

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Some students are unsure about how they'll learn engine and vehicle repair through home study. You may wonder, "Will I really be prepared to work in the diesel engine service field when I complete this program? Will I be able to fix a range of engines found in many types of vehicles?" The answer to both of these questions is yes.

It's important to remember that today all successful professional technicians have one thing in common—training. In the past, "backyard mechanics" learned their skills by tinkering with cars, trucks, or engines in their own garages. However, because of complex, high-tech systems that are used on today's vehicles, you probably wouldn't be able to learn how to fix vehicles properly without some formal training. To properly repair a vehicle today, you must thoroughly understand how all the systems work and how they work together. The easiest, fastest way to get this understanding is to complete a formal training program.

A training program won't simply provide you with a strong background in diesel engine operation and vehicle systems—it will also leave you much better prepared for success in the workplace. Consider for a moment the demands placed on a modern diesel engine repair technician. In a modern shop, technicians are faced with working on a broad range of different systems and equipment types. This means that one day they may be troubleshooting a computer problem related to brake control and the next day a malfunctioning lighting system on a trailer. No person can keep in his or her head all the information required to address such a wide range

of problems, especially when you consider that most fleets include more than one type of engine and vehicle. Instead, technicians receive specialized training (often on a monthly basis) and refer to complex repair manuals and other documentation (most of it computer based) for guidance when performing all but the simplest tasks. How better to learn to work effectively with documentation and improve your ability to interpret written technical material than by studying a program like this? Similarly, successful technicians rely on a strong set of problem-solving skills. Throughout this program you'll be tested on what you've studied by being asked to apply just these types of problem-solving skills to answer exam questions. You should enter the diesel engine repair field prepared for a work life that's full of changing technologies, varied challenges, and lifelong learning. These characteristics are what make your chosen career path rewarding and exciting.

This doesn't mean that a person can't learn to make some repairs on his or her own. In fact, many of the basic skills of engine repair have remained the same for decades. However, it's important to remember that today's diesel engine service technicians (no matter how or where they choose to apply their skills) are highly skilled workers who have learned their trade through formal training programs such as this one. You'll be proud to join the ranks of these professionals when you complete your training.

The topics in this first study unit will serve as a solid foundation of knowledge for you to build on as you move through the program. We'll start by talking about the basic operating systems that make up a diesel-powered truck. Then we'll review the basics of two- and four-stroke engine operation and some important engine performance terminology that you should know. We'll end your first study unit with a discussion of the requirements placed on technicians working in various workplaces.

If you've already worked on engines or vehicles in the past, you may already know some of the information we'll discuss in this first study unit. If so, that's great! You'll have a head start on completing the rest of the program. (Remember, though, it won't hurt to review these important concepts.)

If you're new to these vehicle repair topics, take some time to study this first lesson carefully. As you proceed through the program, the study units will quickly become more challenging, covering more detailed troubleshooting and repair topics. You'll learn all the hands-on skills you need to perform repairs on every vehicle system. For example, later in the program, you'll learn about engines, brakes, electrical systems, fuel systems, transmissions, computer control systems, emission control systems, trailer lighting systems, and all sorts of high-tech testing and repair techniques.

Don't let the idea of "high-tech" vehicle systems intimidate you. Today's engines and vehicles are similar in many ways to those of years past. They contain electronic control systems, for example, but these systems are simply "add-ons" to the same old diesel-fueled engine. The other fundamental engine components have remained the same for many years. Today's engines still have pistons, crankshafts, camshafts, oil pumps, bearings, and so on, just like the engines in our grandparents' day. In fact, it's far more likely that a problem will occur in one of these basic mechanical components than in an electronic component. So while today's technicians must know about the latest electronic systems, they still need the same foundation of basic knowledge that was required in years past.

In this program, we'll concentrate on the repair of diesel engines and freight-hauling trucks. While the exact design of a truck varies from one manufacturer to another, most diesel-powered trucks work according to the same principles. Next, keep in mind that there are few (and sometimes no) major differences between the diesel engines that power these trucks and the engines used in the other applications discussed earlier in this part of your study unit. Therefore, you'll be able to apply most of the skills you learn in this program to working on just about any type of diesel-powered vehicle there is.

## Where Do I Start?

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You'll find important information and a program outline on your student portal. If you haven't read your program outline yet, take a few moments to do so now.

Then, when you're ready, start your lessons by reading through the material in this first study unit. At the end of each section of the study unit, you'll find a short quiz called a *self-check*. These quizzes are provided for you to review your learning. The school doesn't grade these quizzes. Simply answer the questions, and refer back to the text if you need help at any time. You will also find the answers to the self-checks at the end of this unit. As you work through the study unit, remember that you can email your instructor for guidance whenever you have questions.

Many people have negative memories of school or of test-taking. However, remember that the point of taking this program is to learn a professional trade. You shouldn't feel any of the pressures of the formal schoolroom—you make your own schedule. Take all the time you need to read the study unit, review the material, and complete the review quizzes. We want you to do well at your studies!

At the end of each lesson in the program, you'll complete an online multiple-choice examination that will test your learning. The school will grade these examinations. However, there are no time limits on the exams. Don't rush—take all the time you need to review the study unit. When you're confident that you understand the material, complete the exam. As you work on the exam, feel free to refer back to the study unit at any time for reference. The questions are designed to test you on your overall understanding of the topics, so there's nothing wrong with refreshing your memory. Remember, the only object is to learn the material.

After you complete your program, you'll find that your texts will serve as a valuable reference source, helping you to understand and solve all types of repair problems.

## **CASE STUDY**

### ***Trucking's Importance to the Economy***

Now that you've learned something about the type of work done by a diesel repair technician, you might like to know just how big a part is played in the U.S. economy by the industry in which you've chosen to work. The answer is a large one, especially since the trucking industry is the dominant mode of freight transportation in the United States. In 2012 alone, trucks moved 9.4 billion tons of freight, which represents almost 70% of all shipments in the United States. This number, which includes transporting everything from agricultural products and food to engineered products like machinery, far surpasses goods moved by trains or airplanes.

As far as the future is concerned, the American Trucking Associations (ATA) predicts that the trucking industry is poised to explode during the next decade. According to the report, as regulations and technology allow an individual truck to carry more and more freight, they expect a huge increase in the overall tonnage of freight moved each year. As you might guess, more freight moved means greater revenue for the trucking industry and more better-paying jobs for technicians. That's why industry groups predict that the roughly 250,800 diesel technicians currently employed in the United States will increase by 10% in the next decade.

As you can see, trucking is an industry that plays a pivotal role in keeping the United States' economy running. It's a rapidly growing field and one that will continue to help the economy in the future. This indicates that a career in servicing diesel-engine powered vehicles is an important job and one that will provide stability and many opportunities for those like you who enter the field. As a diesel technician, you'll not only be a key part in one of the fastest growing industries in the United States, but also provide an important service by ensuring that countless companies can reliably move their goods all over the country.

You're just about ready to start your study of diesel mechanics with a review of the basic systems of the diesel-powered vehicle. Now take a few moments to review what you've just learned by completing *Self-Check 1*.



# Self-Check 1

**At the end of each section of *Introduction to Diesel Truck Mechanics*, you'll be asked to pause and check your understanding of what you've just read by completing a "Self-Check" exercise. Writing the answers to these questions will help you to review what you've studied so far. Please complete *Self-Check 1* now.**

**Indicate whether the following statements are True or False.**

- \_\_\_\_\_ 1. Gasoline engines always deliver more power than the same size diesel engines.
- \_\_\_\_\_ 2. Once you've learned the basics of diesel engine technology, you'll need to receive specialized training on various occasions to keep up with the changing technology.
- \_\_\_\_\_ 3. One major difference between diesel- and gasoline-powered engines is that diesel engines don't contain crankshafts.

**Complete the following statements with the correct answer.**

- 4. Most freight is transported by equipment that's \_\_\_\_\_ engine powered.
- 5. ASE stands for \_\_\_\_\_ and is a professional certification exam for diesel mechanics.
- 6. The main difference between modern and older diesel engines is that the modern engine will be \_\_\_\_\_ controlled.
- 7. In recent times, \_\_\_\_\_% of freight moved in the United States was transported by truck.

**Check your answers with those on page 99.**

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