UNIT 1
THE CAR AND THE HIGHWAY

4-H
AUTOMOTIVE PROJECT IN CARE
AND SAFETY
# UNIT 1

## THE CAR AND THE HIGHWAY

### AUTOMOTIVE PROJECT IN CARE AND SAFETY

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## ACKNOWLEDGEMENTS

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OUTLINE OF UNITS

The impact motor vehicles — automobiles and trucks — have made on modern living makes it important that each of us have more opportunities to learn about the safe care and operation of automobiles, and for many of us, light trucks.

Here is one of those opportunities, an invitation to participate in the 4-H Automotive Care and Safety Project, developed especially for the maturing club members, 14 years of age and older. Its purpose is to help you achieve and enjoy being a safer and more efficient automobile driver.

Whether or not you have started to drive, the 4-H Automotive Care and Safety Project offers you an opportunity to share with others in your age group, the advantage of learning more about the automobile, how it should be handled on the road, the cost involved in operating it, and how to maintain the car properly. This project is meant to supplement, not replace, any recognized driver training course your school, or community, may sponsor or endorse.

Following is an outline of the contents of the three Units, of which this manual is Unit 1.

UNIT 1: The Car and the Highway

Section I. You and the Automobile.
Section II. Highway Safety.
Section III. Group Activity — Highway Hazard Hunt.
Section IV. What Makes a Car Go! and Stop!
Section V. The Engine in General — Simple Principles of Internal Combustion.
Section VI. Carkeeping.
Section VII. Car Costs and Record Keeping.
Section VIII. Traffic Code and Your Future Responsibilities.
Section IX. Car Inspection — Safety Checking a Car.

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Section VI. What to Look For in Buying a Used Car.
Section VII. Operating Your Car Efficiently.
Section VIII. How to Make Your Community a Safer Place to Drive
Section IX. Group Activities — Economy Run and Driving Skill.
You like cars. All teenagers like cars, so much so that they can hardly wait to learn to drive, and then to own a car. You've never known a time when there weren't automobiles and trucks. But young folk in most other countries, like your great-grandparents when your age, probably never rode in automobiles.

Getting a driver's license, proving one's ability to operate a car with reasonable safety, is a common goal of all young people. It's really something to look forward to, isn't it? But to earn that right calls for planning and preparation.

As a pre-driver you have time to learn what it takes to become a good driver, what is required to drive a car safely and more economically. That's the purpose of this Automotive Care and Safety Project. It is designed to help you learn and understand more about the automobile — how the engine works, how each major part of the car operates, and how to keep the car in good condition. Learning to do these things right before you start to drive will help put you a step ahead as a careful operator of a motor vehicle.

Thousands of 4-H'ers have agreed that this is a good idea — and there's fun in it, too.

Why is learning about automobiles important?

For one thing, more than 132 million motor vehicles operate on our streets and highways today. Did you know that 80.5% of all families in the United States own cars?

Another reason is that for most families an automobile represents a large investment of money, both as to initial cost and to upkeep.

But whether a family owns a car or not, and regardless of the cost, motor vehicles are a vital part of American life. You'd have difficulty naming all the ways they serve you and your family, and it would be just as hard to think what it would be like without these services.

Probably no other invention has had a greater impact on American economy and society. The automobile industry has created millions of jobs, helped raise wages and the standard of living. Cars and trucks play a key role in our modern system of production and distribution of goods and services.

While it is just as far from here to there as it was 50 years ago, motor vehicles have become distance-shorteners and time-savers, as we travel over the greatly improved road and highway systems that have been forced into being.

As a result your school is bigger, better equipped, more centrally located. You can attend educational and sporting events at rival schools because cars and buses provide quick, low-cost transportation. You can take advantage of more vacation and recreational travel because motor vehicles have greatly reduced the time, and in the case of family units, the cost of getting there and back.

The automobile speeds doctors on calls, brings clinics and hospitals within the reach of all. Everyday needs — food, fuel, medicine, mail — reach you faster and at lower cost.

Trucks move the products of farms, canneries and factories quickly to markets and stores. Almost everything you eat, wear, or otherwise use, travels at least part of its way to you over the highway in trucks or cars.

Many businesses, unknown a few decades ago, have been created because of widespread use of motor vehicles—motels, drive-in theaters, shopping centers, for example. You may think of a dozen others.
Motor vehicles and highway transportation have helped to make America great. Truly we’re a nation on wheels and our economy has prospered because of it. Did you know that Americans own almost two-thirds of all the automobiles in the world, while we make up only one-sixteenth of its population? Primitive forms of transportation in many countries act as a giant brake on the whole economy, because the methods of moving people and goods are cumbersome and costly.

So much for the plus side of motor vehicle use, the benefits. What about the minus side? It needs the attention of every driver and pre-driver, because the matter of motor vehicle accidents is a serious one.

Every year thousands of people are killed, and hundreds of thousands are maimed and injured in accidents on our streets, roads and highways. Property damage alone amounts to billions of dollars; no monetary value could ever be placed on the lives lost.

Traffic accidents need not happen, and most could be prevented if each driver, while behind the wheel, remains aware of the power and potentiality of the motor vehicle he is driving and keeps it under constant control.

Your Automotive Care and Safety Project is designed to help you cultivate the proper attitude toward others on the road, and toward the necessary driving skills, in an effort to greatly reduce the number of traffic mishaps. You will learn how a substantial part of the highway toll can be avoided through proper use and care of your automobile.

You will enjoy your progress from one section to another — from one 4-H meeting to another.

- Do you have a better understanding of the importance of the motor vehicle on the American way of life? This is the primary objective of this section.
- What basic elements of highway safety do you need to know? That's coming up when you have a meeting on highway safety and a hazard-hunt activity.
- Do you have a deep appreciation of traffic and other laws related to the operation and ownership of motor vehicles? That's coming up under "Rules for the Road."
- What principle service and maintenance operations should you be able to perform? These include such elementary tasks of car maintenance as cleaning and polishing, care of tires, checking under the hood, etc.
- How many basic parts of a car can you name? You'll discover some of these when you do activities under "What Makes a Car Go! and Stop!"
- Do you know what principles of force and gravity are at play in safe motor vehicle operation? You'll learn more about these later.
- How much does it cost to own and operate an automobile? Wait, you may be surprised.
- Are you interested in career opportunities in the automotive field? You'll get some insights into these.

With this brief background of the significance of the motor vehicle and the objectives of the Automotive Care and Safety Project, we are ready to launch into what could prove to be one of the most interesting experiences you'll have in 4-H.
UNIT 1, SECTION I

YOU AND THE AUTOMOBILE

LET'S DISCUSS

Read through quickly and check whether you agree or disagree. Then discuss the questions together. You might want to try these on your family also.

<table>
<thead>
<tr>
<th>Agree</th>
<th>Disagree</th>
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<tr>
<td>1. My family could get along without an auto.</td>
<td></td>
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<td>2. Automobiles are more important to people outside of metropolitan areas, than to city people.</td>
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<td>3. Automobiles are too powerful today.</td>
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<td>4. For most families the automobile represents a large investment.</td>
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<tr>
<td>5. Motor vehicles have created a need for many businesses unknown a few decades ago.</td>
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<tr>
<td>6. More people are injured or killed in auto accidents than by any other cause.</td>
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<td>7. Most automobile accidents could be prevented.</td>
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<tr>
<td>8. Most teen-agers know how to drive properly when they reach legal age.</td>
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LET'S DO

Each member is to do the following:

1. List five main ways the car is used by your family. a. 

   b. 

   c. 

   d. 

   e. 

2. What changes would have to be made if suddenly there were no automobiles in your community? 


4. What do you do now in the care of your family car? What do you and your family think you could do as a part of this project in caring for the car? 

5. Find out from your parents what the price range of their car was when new. What year and model is it and how long do they plan to keep it.

6. If a person earns $50 a week, how long would it take at that rate to purchase the average low-priced car, using the entire amount each week? 

7. Report on the most interesting auto trip that your family has taken in your present automobile.

8. Discuss any auto accidents which have occurred in your family during the past year.

9. Divide your club into smaller groups and do the following:

   a. Find out how many cars there are in your county

   b. Talk to an exchange student or a person who has traveled in another country and give information about motor vehicle use in that country.

   c. Talk to three neighbors and find out what concerns each most as a driver in your community

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"Traffic accidents don't just happen—they're caused."

No doubt you've heard that slogan a lot of times, but have you ever really thought what it means?

It tells us that accidents are caused, but by whom or what? By carelessness or poor judgment on the part of the driver? By some defect in the car itself? By hazardous road conditions?

Studies show that 17 out of 20, or nearly 85% of the traffic accidents are a result of driving errors; the other 15% are a result of mechanical failure or of road conditions, which may also be somebody's error.

It won't be long now until you will be driving and will be exposed to the possibility of traffic accidents. How you meet the test of everyday driving depends upon: (1) how well you learn to drive before attempting to operate a motor vehicle; (2) how well you know the rules of the road; and (3) how sound an attitude you have towards driving responsibilities.

It is no secret that many adult drivers are "set" in their poor driving habits, because they did not learn to drive the right way. Many of them began to drive with poor attitudes and have not been able to change. Many have already had an accident and probably will have another before their driving career is over.

This is where you can get the jump on them—you have not had time to pick up a lot of bad driving habits. With the proper training and right attitude, you can learn to be a real "pro", to be one of the best drivers on the road. This is why it is important to learn about safe driving BEFORE you start to drive.

Driving is not kid stuff. It requires mature skill and judgment. Unfortunately many young people have not learned that responsibility goes with driving a car.

As a result, they are involved in more than their share of accidents. For example, during a recent year, 10.3% of the licensed drivers were under 20 years old but they were involved in 19.1% of the total motor-vehicle accidents.

Let's take a hard look at the teenage traffic accident situation, and then consider some things we can do to improve it. During a recent 12 month period, teenagers:

Were involved in accidents at the rate of 1 for every 5 licensed drivers.

An average of about 13,300 teenage drivers were involved in accidents per day.

Were responsible for an estimated loss of $4,300,000,000 in motor vehicle accidents.

Teenagers have also experienced a large proportion of convictions for traffic offenses when compared with the number of licensed drivers in their age group. For example, in New Jersey, one study showed 14% of the convictions were for teenagers, yet they comprised only 4.4% of the drivers.

Though teenagers have a high accident rate, they are not the only ones that have accidents. In 1975, some 46,000 persons were killed in motor-vehicle accidents and about 1,800,000 suffered disabling injuries. The total estimated cost of these accidents amounted to $21,200,000,000.

Think of it! During those 12 months, one person was killed on our highways every 11 minutes! And, somebody suffered a disabling injury every 18 seconds!
Where do most of the fatal motor-vehicle accidents occur? In the city, you think? No. In rural areas! In fact, 65% or almost 2 out of every 3 traffic deaths occur in rural areas. On the other hand, motor-vehicle accidents pile up more non-fatal injuries and property damage in the cities.

Of the 5,800 recent accident fatalities among farm residents, 48% or 2,800 involved a motor-vehicle.

If fact, the traffic accident problem is so serious that at the present rate it is estimated one out of every two Americans face the prospect of being injured or killed in a motor-vehicle mishap during his lifetime.

So you see why it is so important, when you reach driving age, to be a safe driver. By operating your car skillfully and according to the rules of courtesy and good sportsmanship, you will automatically shoulder the responsibilities which go with your privilege of driving.

The best way to get the proper skill for driving is through training in a driver education course. If such a course is offered in your high school, enroll as soon as you become eligible. If it is not offered there, ask your parents to help you get the proper, approved training. In any event you should not start driving until you have been properly trained.

Knowing how to handle a car is all well and good, but there is something else a good driver must have — a knowledge of the rules of the road. This means you must learn and understand the laws about speed, passing, stopping, turning, signalling, right-of-way, parking, and similar traffic regulations.

Not only is this knowledge absolutely necessary to pass a driver's license examination, but also to pass the test of everyday driving.

Knowledge of the rules of the road, and the skill of handling a car are key factors in good driving. But better and safer driving also depends upon care, courtesy and caution. In other words, it is achieved by proper driving attitudes which are not defined by law.

A highway safety expert would define it as a willingness to assume responsibility, to respect the traffic laws, to have proper consideration for your fellow driver, and to show a general spirit of cooperation on the road.

In fact, are not these the very same basic qualities that describe a good 4-H'er in all other areas of activity?

A good attitude can be said to extend to just about everything you do when you drive. Even to a rather simple thing like allowing yourself enough time to reach your destination so you won't have to drive faster than you should. It also extends to the duty of keeping your car in a safe operating condition at all times.

Practicing highway safety isn't hard. In driving as in everything else, learning to do things the right way is just plain common sense. It really pays off, too. If you try to do the things discussed in this section — both in pre-driving experiences and after you take the wheel of a car — you will be doing your part.

The normal field of vision is about 188 degrees but the angle of focused vision is narrow. When driving, the eyes should be moved constantly to pick up details both on and off the road.
UNIT 1, SECTION II      HIGHWAY SAFETY

LET'S DISCUSS

Now that you have become aware of the seriousness of the highway accident problem, list some ways that the situation can be remedied. Use a separate sheet of paper where called for.

1. Describe or demonstrate safe passing procedures. ____________________________

2. List "Rules of the Road" for the pedestrian to observe. Diagram a situation showing pedestrian rules. ____________________________

3. What are attitudes? (Your definition) ____________________________

4. Why are attitudes important in safe driving? ____________________________

5. Identify six good driving habits you have observed in your community. ____________________________

6. What are the opportunities available to you to learn to drive? ____________________________

7. What are safe highways? ____________________________

8. What is the population of your county or city? ____________________________

As a group, select two or more of the following activities:

1. a. Invite an informed person in your area to talk to your club. Ask him to describe a serious accident he has seen. From that, each member can diagram how the accident occurred and what were the major factors causing it. Speakers might include motor club officials, local or state police, judges or traffic court magistrates, driver education instructors, etc.
   b. If you have seen an accident, diagram the situation on another sheet of paper. In your own mind, determine the causes and how the accident might have been avoided.

2. Sponsor club exhibits on highway safety at local, county or state shows or in local stores.

3. Prepare and present demonstrations on safety subjects such as: a. Walking on the highway. b. Riding the school bus. c. Riding a bicycle safely.

4. Form team in your club and debate resolutions such as: "Cars in poor condition are responsible for too large a percentage of our highway accidents." "There should be compulsory periodic motor vehicle inspections." There should be periodical re-examination of applicants for operator's licenses."

5. Present a program on some phase of highway safety before school, PTA, service clubs or other organizations, and seek the organization's support in promoting it.

6. Find out if there is a highway safety program or safety council in your area. On a separate sheet of paper, list the ways your club could support it.

7. Check to see that cars, trucks, bicycles, tractors, trailers and farm machinery belonging to your family which travel on the highway at night are properly lighted. Be sure farm machinery carries slow moving vehicle signs (SMV).

8. Establish a shelf or library of free highway safety literature.

9. Promote Dad-to-Daughter and Man-to-Man Good Driving Agreements in your group. Information can be obtained from your Highway Safety Council.

10. Work toward community support for a driver education program in your school through the Student Council and other groups.

11. Clip the daily newspaper for one month for articles on motor-vehicle accidents and highway safety.
A driver faces a challenge every time he starts out to drive anywhere. His job is to get his automobile from one place to another without an accident.

That doesn't sound too difficult, you think, until you realize that there are many chances for accidents, even on a short trip. Research has shown that under common driving conditions there are an average of 200 potential accident-producing situations per mile.

Many things go into making a good driver, but the most significant of these is the ability to spot hazards (or dangers). It is necessary to sense them before they become obvious — and just as important to know what to do about them in time to avoid an accident. As an example, an alert driver knows that when a ball comes rolling into the street it usually is followed by a child. The good driver's instinctive reaction is to stop immediately.

Let's face it, this is one of the most serious problems you or any new driver will have: to recognize situations that spell trouble and know what to do to avoid them.

Experts usually say that the only reason teenagers have more than their share of accidents is that they lack experience. What they really mean is that they lack experience in recognizing and coping with driving hazards.

Now is the time to start getting that experience before you drive. The ability to recognize hazards can be developed through study and practice.

There are many simple hazards that any driver should be able to spot. Some of them include:

- Hidden driveways leading onto the highway.
- Blind road intersections (you can't see what is coming from either direction).
- Soft road shoulders.
- Blind curves.
- Broken pavement and holes in the road.
- Wet or icy pavements.
- Heavy dust or fog.
- Narrow bridges or culverts.
- Illegible warning signs.
- Slow-moving vehicles.
- Playgrounds and school yards.

A good driver is always on the watch for these common hazards, and for others not so obvious. The ability to spot clues of possible danger may mean the difference between life and death.

Obstruction of vision is often a factor in fatal motor-vehicle accidents. For instance, the National Safety Council reports that on the basis of information from 17 state traffic authorities during a recent year, the driver's vision was obscured in one out of six fatal accidents.

In two out of five cases the obstruction involved the vehicle itself, such as rain, snow or sleet on the windshield. About one-third of the obstructions were trees, buildings and other things along the highway or adjacent to it. In most of the remaining cases the obstructions were other cars, some moving, some parked.
UNIT 1, SECTION III GROUP ACTIVITY — HIGHWAY HAZARD HUNT

LET'S DO

1. Highway Hazard Hunt
   Obtain a road map of your community from your county highway commission or your police officials. Carefully study the roads in your community.
   After you have studied the map, plan a field trip for the club to make together with the parents, advisory committee members and leader.
   The purpose of the trip is to see how many hazards you can locate. As you find hazards, mark their location on your map. Upon your return, use the map to discuss the hazards in detail with your leader, parents and law enforcement officials. Also discuss what your club might do to correct them or help to have them corrected.

2. Accident Location Map
   On the same map marked with the hazards, keep a record of where motor-vehicle accidents occurred during a period of at least one month. A sample reporting form is printed below, to be filled out for each accident. Learn why and how each accident happened, and discuss how each might have been prevented.
   Ask your local police officials to aid you in collecting and interpreting the facts, and in completing the accident report form. It will make the project more interesting.
   Organize a safety committee in your club to coordinate your work. Conduct a community highway safety program based on the facts you learned from studying the accidents and hazards around your community.

LET'S DISCUSS

1. Discuss the hazards found on your field trip.

2. What did you find to be the most common hazards?

3. How can these hazards be corrected? What can your club do to help correct them?
4. There are ______ miles of highways and roads in the county. The leading cause of fatal accidents in the county is ____________________________

The most common highway hazard is __________________________________________

5. What community agencies helped in your highway safety program?

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

**4-H Highway Safety Project Accident Form**

Name of Driver ____________________________ Age ___ Sex ___
Address ____________________________
Occupation ____________________________
Name of Driver (if second car is involved) ____________________________ Age ___ Sex ___
Address ____________________________
Occupation ____________________________
County ____________________________
Location of Accident ____________________________
Date ________________ Time ________________ No. of Vehicles Involved ___ Property Damage ___
Cause of Accident (speed, passing on hill or curve, mechanical defects, etc.) ____________________________
Violations Indicated ____________________________
Name of Person Killed ____________________________ Address ____________________________ Age ___ Sex ___
Name Of Person Killed ____________________________ Address ____________________________ Age ___ Sex ___
Name of Person Injured ____________________________ Address ____________________________ Age ___ Sex ___
Name of Person Injured ____________________________ Address ____________________________ Age ___ Sex ___
Precautions Which Might Have Prevented Accident: ____________________________

__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________
__________________________________________________________________________

13
An owner's manual is included with every new car. The manual can help the operator become familiar with the instruments and controls, and can give helpful hints for safe and economical car operation.

Each car has a panel of instruments and gauges on the dashboard immediately in front of the driver for his convenience. These help him check at a glance on the car's operation and speed, and for controlling lights, air and temperature, windshield wipers, radio, etc. All are explained in the owner's manual.

An ignition key is required to start the engine. One key may fit all locks in the car, or there may be one or more keys for the doors, trunk compartment, spare tire lock, besides that for the ignition. Usually a double set of keys is issued with each new car. You will want to learn what lock each key operates and to identify each readily.

What makes a car go? Why, the engine, of course, starting it by inserting and turning the ignition key. But will the car move? No, the wheels must turn to make the car actually "go." And to make the wheels turn a certain gear must be selected, manually or automatically. Thus you need the engine, a gear mechanism, and the wheels to make a car go.

A lot of people forget about the second part of this power chain. While the engine may be running and turning a crankshaft at a certain speed and force, unless that force is transmitted to the rear wheels (some vehicles have a four-wheel drive) through a system of gears, the wheels will not go around and move the car. A lot of things happen between the engine and the wheels.

The first thing behind the engine is the CLUTCH. Its job is to connect or disconnect the engine to or from the rear wheels and the remainder of the power transmission system. The clutch permits starting and stopping the engine and car, and shifting the gears. Many cars have automatic drives in which the clutch pedal is eliminated, and a fluid device serves as the clutch.

Directly behind the clutch is the TRANSMISSION. It is used in automobiles to allow for a change in the speed of the engine in relation to the speed of the rear wheels. The transmission is a system of gears which provide for the engine speed to be "geared down" to get full power at slow speeds; and so the car may be operated in either direction. It provides increased pulling force, and also allows the engine to run faster. This is important because the engine does not develop very much power at low speed.

There are three types of transmissions:

1. Conventional type with three speeds, forward and one reverse. Gear shifting is done by the driver using a lever in a prescribed pattern, commonly known as "stick-shift drive."

2. Conventional type with Overdrive feature, which permits a fourth speed after speeds of 20 to 30 miles per hour are reached. To return to conventional high gear the accelerator must be pushed to the floor. In most cases the overdrive may be "locked out" by use of an overdrive control handle.

3. Automatic type which largely eliminates the need for selection of different gear ratios by the driver. Instead, the lever on the steering column is set to the desired ratio for forward movement (or reverse, if desired), and the automatic transmission takes over delivering the proper torque or driving force or effort to the rear wheels in accordance with car speed and power requirements.
The heart of an automatic transmission is a fluid coupling. It couples the engine with the rear wheels, transmitting the power there through a fluid such as oil. A simple fluid coupling demonstration can be made with two electric fans.

If the fans were placed a few inches apart and facing each other, and if one fan were started, the air from it would cause the fan blades of the other fan to turn. In this case the "fluid" is air, but such a coupling would not be very efficient.

To make a more efficient coupling two fans are used to look much like a hollowed out doughnut sliced in half, with blades called vanes, set in the hollowed halves. Oil is the fluid used in the vanes, making a fluid coupling.

Torque converters and gear systems are used with fluid couplings to deliver power from the engine to the transmission, and at the same time step up the turning effect delivered to the propeller shaft. All automatic transmissions make considerable use of the gear-set known as planetary gears. This name comes from the general appearance of planets rotating in an orbit around a sun. The compactness and versatility of the gear-set has contributed to its wide use.

The planetary gear-set or gear train may be used to increase power and decrease speed. It may be used to reduce speed and reverse direction of rotation. It may also be made to function as a coupling in direct drive.

The PROPELLER SHAFT connects the transmission main shaft and the differential, carrying the rotary motion of the main shaft to the differential. From there it is transmitted to the rear wheel axles.

While the engine and transmission are more or less rigidly attached to the car frame, the rear wheels, axles, and differential are attached to the frame by springs. When the wheels go over rough roads, the springs expand or compress as the wheels, axles and differential move up and down. As a result the rear end of the propeller shaft moves up and down, causing the angle between the transmission main shaft and the propeller shaft to change. Also, the distance between the transmission and the differential changes. To take care of these two changes, angle and distance, the propeller shaft includes two different devices. One is the universal joint to permit a change of angle, and the other is a slip joint permitting the length of the shaft to change.
In the rear axle there are two sets of gears combined in the DIFFERENTIAL assembly. These enable the propeller shaft to drive the rear axle shafts, and also permit one axle to go faster than the other when the car turns a curve.

If a car never would have to turn a corner it would not need these differential gears. But when a corner is turned the outside wheel has to travel farther than the inside wheel, and so has to go faster during the turn. For example, when a car makes a 90° turn with the inner rear wheel turning on a 20-foot radius, the inner rear wheel travels 31 feet while the outer rear wheel travels about 39 feet. The set of differential gears causes this to work and the action is entirely automatic as long as both wheels maintain firm contact with the road.

When one wheel is on a firm road surface and the other on a slick spot, such as ice or mud, the one wheel stands and the other spins. The nonspin differential overcomes this slippage by the use of specially designed clutch plates in relation with the differential gears.

The axles drive the wheels which make the car move. We now have a complete drive system just as was outlined at the beginning of this section. Power starts at the engine and eventually, after passing through various mechanisms so that it arrives in the proper form, gets to the rear wheels.

But the car has to stop sometime, and that takes BRAKES. Most cars have two independent braking systems. One, operated by a pedal, is used most frequently and is known as the "foot brake" or "service brake." The other brake is usually operated by a hand or foot lever and is intended primarily as a "parking brake." But if the service brake fails to stop the car, the second system can be used as an "emergency brake."

The SERVICE BRAKE system has a brake in each of the four wheels. The braking action is like rubbing a stick against the rim of a child’s wagon wheel. In the automobile, brake "shoes" covered with a special friction material are forced against the inside of a metal drum which rotates with the wheel. A system of tubes filled with liquid (heavy duty brake fluid) runs from the brake pedal in the driver's compartment to each brake, and this fluid transmits pressure from the driver's foot to the brake shoe.

The PARKING BRAKE may be a single brake band that acts on a small drum mounted on the propeller shaft at the rear of the transmission, or it may be connected in a manner to use the rear wheel brake shoes of the hydraulic brake system. It sometimes is called the emergency brake. On the hand lever type a trigger-released ratchet locks the lever in any desired position. On the foot operated type a "step on" parking brake pedal is provided. It generally is released by hand.

TIRES are an important part of automobile wheels and have a great deal to do with safety, comfort and general operation of the car. Tubeless tires are standard equipment on most cars.
The following suggestions can be helpful in obtaining good tire service.

- **Pressure** — Maintain pressure as suggested in the owner's manual.

- **Inspection** — Tubeless tires will pick up nails and other objects without a noticeable loss of air, which normally would cause a tire and tube to go flat. Regular inspection is suggested in most owner's manuals.

- **Changing a wheel** — Under many present day conditions tires seldom need changing on the road and many drivers caught with a "flat" are at a loss to know how to change a wheel. It would be well to practice the procedure of mounting the spare as illustrated in the owner's manual.

- **Switching tires** — Switching or rotating tires will give longer tire mileage. The recommendations in the owner's manual should be followed. This is especially true when the car is equipped with radial tires.

- **Balancing tires** — Tires may wear unevenly from several causes. Any abnormal vibration in the steering may be a sign that a tire has lost its original balance. In case of undue wear it is well to rotate the tires and then have the front wheels balanced by a competent serviceman.

- **Wheel alignment** — It is also true that a car may lose its proper front wheel alignment, causing poor steering and uneven tire wear. A check by a competent serviceman at least once a year is recommended to insure good steering and long tire life.

- **Safe tread** — Good tread on tires is important to the safe operation of a car. A fast stop may be necessary at any time, and one factor in car control is good tire traction. Smooth tires give poor, uneven braking, and tend to let the car slide just when the driver needs complete control. Many states now have laws dealing with minimum allowed tread depth.

The average car consists of four main, basic parts:

1. **The engine** — the "heart" of the car located in the engine compartment under the hood at the front end of the car. (Some foreign cars are the exception) It produces the power to move the car. Proper identification of parts will help to better understand the car's operation.

2. **The power train or drive system** — It is a network of clutches, gears, shafts and axles that transmit power from the engine to the drive wheels.

3. **The Chassis**. This is the framework on which the other parts are mounted, including the front suspension, front and rear wheels, steering gear, springs, shock absorbers.

4. **The Body**. The remainder of the car, including the driver and passenger compartments, windshield and windows, roof, hood, trunk lid, fenders, etc.
UNIT 1, SECTION IV  WHAT MAKES A CAR GO — AND STOP
LET’S DO

1. Check all cars at your meeting to see that lights are working — high beam and low beam — tail and directional signals.

2. Arrange for a demonstration at a garage of head light adjusting.

3. Complete the following information about your family car:

Make of Car __________________ Model __________________

Name of Keys __________________ Function __________________

Inside door locks. Type __________________

Front door type __________________

Rear door type __________________

Hood latch. Location __________________

Panel:

   Ignition Switch __________________

   Turn __________ to turn on ignition.

   Turn __________ to turn on and start motor.

   If separate starting switch where __________ how operated __________________

   Turn __________ to operate accessories only.

Oil pressure indicator type __________________

   Hand __________ high, low __________ Warning light __________ normal, low __________

Fuel Gauge __________________

   Location __________________

   Special indication for low supply __________________

Temperature Gauge __________________

   Location __________________

   Cold _______ Normal _______ Hot _______ Other _______

Generator Indicator (if car is equipped with one) __________________

   Location __________________

   Pointer ______ + __________ Warning light __________

   Other __________________

Speedometer __________________

   Location __________________

   Dial numbered _______ to __________

Main lights control __________________

   Parking lights _______ how controlled __________________

   Head lights _______ how controlled __________________

Panel lights _______ control __________________

Interior lights _______ control __________________

Windshield wiper control __________________

   Location __________________

   Positions On _______ Off _______ Other _______

Manual choke control (not on cars with automatic chokes) __________________

   Location __________________
Heater - Air Flow Controls
Location ________________________________
List positions ________________________________

Other controls:
Parking brake position ________________________________
   To release ________________________________
Headlight beam selector ________________________________
   Position ________________________________
Other air flow controls ________________________________
   Position ________________________________

Front seat adjustment
Location ________________________________
   Inches seat can be moved ________________________________
   Inches seat can be raised or lowered ________________________________

Directional signals
Location of indicator lights ________________________________

Gears
Standard transmission ________________________________ yes no
Over-drive ________________________________ yes no
Automatic transmission ________________________________ yes no
   Positions (selector lever or stations) ________________________________
   Engine starts only when lever is at ________________________________

Gas tank
Filler opening location ________________________________ Capacity of tank ________________________________ gallons.

Breaking in
Recommendations for breaking in new car are:
1. ________________________________________
2. ________________________________________
3. ________________________________________
4. ________________________________________
Other ________________________________________

Brakes
What advice is given on brake adjustment:
1. ________________________________________
2. ________________________________________
3. ________________________________________
Other ________________________________________

Parking Brake
Give information that is listed as to the use of the parking brake:
1. ________________________________________
2. ________________________________________
3. ________________________________________
Other ________________________________________
UNIT 1, SECTION IV  
WHAT MAKES A CAR GO — AND STOP

Safety

What cautions or warnings are given in the manual?
1. 
2. 
3. 
4. 
5. 
6. 

Other

4. Study the underside of a car on a hoist at a garage or service station.
   b. Locate — foot brake — parking brake — master cylinder.
   c. Check the hydraulic system for possible leaks and dents with the aid of the leader.
   d. Identify other parts of the car.

5. Check tire pressure and inspect all tires.

6. Demonstrate the safe use of a jack.

7. Demonstrate changing a wheel.

8. Have a wheel alignment demonstration at a garage or service station, with use of alignment equipment.

9. Have leader or attendant pull a wheel and show parts of the brake.

10. Complete the following statements:
   Tire pressure recommended for your car ________________________________
   Tire pressure as measured on your car ________________________________
   Size of tires ________________________________
   Depth of tread left front right front left rear right rear spare
   Is jack in order? 
   General condition of tires (Check for smooth treads, bad cuts, injured sidewalls, uneven tread wear.)
   left front ________________________________
   right front ________________________________
   left rear ________________________________
   right rear ________________________________
   spare ________________________________
   Foot Clutch yes no ________________________________
   Transmission conventional ________________________________
   over-drive automatic ________________________________
   Position of over-drive lever if equipped ________________________________
   Forward driving positions on automatic drive ________________________________
LET'S ANSWER

1. The gasoline tank holds only 10 gallons. (yes) ______ (no) ______

2. Oil pressure gauge indicates quantity of oil in the engine. (yes) ______ (no) ______

3. A small light on the panel indicates when the head lights are on high beam. (yes) ______ (no) ______

4. When you can push the brake pedal to the floor it is in proper adjustment. (yes) ______ (no) ______

5. The parking brake can also be used for emergency stops. (yes) ______ (no) ______

6. Always be sure that the parking brakes are fully released before moving the car. (yes) ___ (no) ___

7. A full stop is recommended when changing gears from forward to reverse or reverse to forward. (yes) ______ (no) ______

8. All car keys are numbered by the manufacturer. (yes) ______ (no) ______

9. It is recommended that the gears be in neutral before starting the engine. (yes) ______ (no) ______

10. Starting and running an engine in a closed garage is dangerous. (yes) ______ (no) ______

11. A clutch is used so that the engine may run with the car standing still. (yes) ______ (no) ______

12. The universal joint is directly behind the clutch. (yes) ______ (no) ______

13. The universal joint (A. allows the rear axle to move up or down in relation to the transmission without bending or breaking the shaft.) (B. allows the transmission gears to rotate without turning the rear wheels.) (A) ______ (B) ______

14. The parking brake is effective on all four wheels. (yes) ______ (no) ______

15. The purpose of the differential is to (A. give a different speed to each wheel when turning.) (B. give a lower gear ratio for hard pulls.) (A) ______ (B) ______

16. The drive shaft is used to connect the transmission to the rear axle. (yes) ______ (no) ______

17. With tubeless tires the air pressure remains constant regardless of speed. (yes) ______ (no) ______

18. Front tires can be abnormally worn by (A. tires underinflated.) (B. broken leaf spring.) (A) ______ (B) ______

19. The transmission is used only to change direction of travel. (forward to reverse) (yes) ______ (no) ______
— Simple Principles of Internal Combustion

The ENGINE is the power plant of an automobile. All present-day automobiles are powered by INTERNAL COMBUSTION engines. Internal means inside or enclosed; Combustion means the act of burning. Thus an internal combustion engine is one in which the fuel burns inside a series of containers, called cylinders. The power that is generated by the burning is transmitted to the crankshaft (as mentioned in Section IV) by means of a close fitting piston. The piston moves down in the cylinder, and back up, on a rod connected to the crankshaft.

The CYLINDER is a hollow tube or “container, open at one end.” The PISTON is a cylindrical object which slides up and down in the cylinder with very little clearance. Thus it seals the other end of the cylinder.

The CONNECTING ROD is a straight rod, with one end fastened by a pin or pivot to the piston, and the other end connected to the crankshaft.

The CRANKSHAFT is a long rod or shaft with its ends mounted in oiled bearings so it can revolve freely. Its center section is a series of “cranks,” one for each cylinder, which describes a full circle as the shaft turns around. The lower end of each connecting rod is fastened through a bearing around its “crank.” In following the same circular path the crank makes, it moves its piston up and down in the cylinder.

To make an engine run, you need three things — FUEL, AIR, IGNITION. The fuel mixes with the air, resulting in what is called an air-fuel mixture. Then this mixture is ignited by a spark from the spark plug, burning very rapidly and generating considerable heat. The heat causes the air-fuel mixture to expand, pushing the piston down. The process is repeated rapidly in each cylinder.

This action changes straight line, back and forth motion to a circular or rotating motion, very similar to that of the bicycle rider’s leg and foot in the nearby illustration.

In an engine, when the piston is pushed downward by the exploding pressure of the burning mixture of air and fuel, the upper end of the connecting rod moves downward with its piston in a straight line. This is comparable to the action of the knee and lower part of the leg in our bicycle illustration. The lower end of the connecting rod must move downward also, but in addition it moves in the circular motion prescribed by the crank to which it is attached. This is like the foot action in our illustration.

Thus the four basic parts of an engine — cylinder, piston, connecting rod, crankshaft — perform the same motions repeatedly while the engine is operating, just like a bicycle rider’s legs must if the rider wishes to keep moving. One complete series of motions in an engine is called a CYCLE. Most internal combustion engines today are FOUR-CYCLE engines, that is, it takes four strokes — two up and two down — of a piston to complete a full-cycle or series. Then it starts all over again.
Start with the piston at the top of the cylinder, as far as the crank and connecting rod will let it go, but leaving a small space above it. On the first stroke the piston moves down, or away from the closed end of the cylinder. This is called the INTAKE STROKE, because during it the fuel-air mixture is drawn into the cylinder.

There are various ways of getting this fuel-air mixture in, but for the time being we'll assume that there is a "door" of some kind in the top of the cylinder which can be opened and closed as desired. The cylinder will be full of the fuel-air mixture when the piston is at the bottom of its stroke, and the crankshaft has gone halfway around. Then the intake door is closed.

Now the piston starts to go up, and this stroke is called the COMPRESSION STROKE. It compresses the fuel-air mixture so that instead of filling the whole cylinder it now is squeezed into the small space at the top. The piston is back where it started from and the crankshaft has gone all the way around once.

The ratio of the whole cylinder volume to that of the small space left when the piston is at the top, is called the COMPRESSION RATIO. For example, suppose the cylinder held 80 cubic inches when the piston was at the bottom, and 10 cubic inches when at the top. You would say that the engine had a compression ratio of 8 to 1. That means that when the piston is at the top the fuel-air mixture is squeezed to one-eighth of its former volume.

As the piston reaches the top of its upward stroke (compression stroke) the fuel-air mixture is ignited, and expands as it starts burning. This pushes the piston down, and this third stroke is called the POWER STROKE that you really have been getting ready for all this time. The pressure forcing the piston down to its bottom position again is what makes the engine provide power.

The fourth, or second upward stroke is called the EXHAUST STROKE. By this time another "door" in the top of the cylinder has been opened and the hot gases, the result of the burning fuel-air mixture, escape through it. The rising piston helps push them out. At the end of this stroke the cylinder is practically clear of burned gases, and the piston is ready at the top to repeat the complete cycle again.

The crankshaft has now gone all the way around twice. One of the principle features of the four-stroke-cycle engine is that the crankshaft makes two complete revolutions during every cycle. That is, there is only one power stroke to two revolutions of the crankshaft.

The four-stroke-cycle is often called the OTTO CYCLE, from the name of the man who built the first engine of this type more than 75 years ago. To keep the essentials of this cycle straight in our minds it is necessary to remember only four words in proper order: Intake, Compression, Power, Exhaust.
Another type of engine is known as a TWO-CYCLE (two-stroke-cycle) engine. This one completes all four functions we have just discussed in two strokes. On the POWER or "down" stroke, before bottom dead center (B.D.C.) is reached, an exhaust port is opened to allow exhaust gases to escape. Shortly after the exhaust port has been opened a second port is opened, the intake port. The incoming mixture of fuel and air helps to purge the exhaust gases from the cylinder.

On the COMPRESSION or "up" stroke the intake and exhaust ports are closed and the mixture is compressed in preparation for ignition and the following power stroke.

The crankshaft has made only one complete revolution. Thus the two-cycle engine differs from the four-cycle in that it delivers power on one revolution of the crankshaft. Each time the piston goes down it's on power.

There are various methods of getting the air-fuel mixture into, and the hot gases out of the cylinder. The most common is through holes or passages at the top of the cylinder which are opened and closed at the proper time by POPPET VALVES. The number of valves or "doors" per cylinder is normally two, an intake and an exhaust valve.

The INTAKE VALVE opens before the piston reaches "top-dead-center" (T.D.C.) and starts down again on the intake stroke. The piston in moving down creates a partial vacuum in the cylinder, lowering the pressure inside, and the atmospheric pressure on the outside pushes the air-fuel mixture in to fill up the space. The intake valve remains open until the piston starts up again.

The EXHAUST VALVE is opened before the piston reaches the end of the power stroke. The hot gases are forced out through it by the piston moving up on the next or exhaust stroke. The exhaust valve does not close until the piston reaches T.D.C. and has started down again on the intake stroke.
The valves are located in the block beside the cylinders in some engines; this arrangement is called the "L-head" type. Many engines have valves located in the head of the engine and are commonly called "over-head valves," but the proper name is "I-head" type. Some engines have one valve in the block and the other in the head. This is called the "F-head" type.

So far the discussion has been about the operation of a single cylinder, but automobiles aren't "one-lungers" anymore. Today autos have four, six, or eight cylinders. An engine with cylinders side by side is a "Straight Engine," or "In-Line Engine." The other common engine arrangement is the "V-Engine," where two banks or rows of cylinders beside each other use the same crankshaft. Engines can also have a "Flat" cylinder arrangement, called "Pancake Type" engines.

With many cylinders working together, the crankshaft is designed so that when the power stroke is occurring in one cylinder, compression is going on in a second, intake in a third and exhaust in a fourth. Therefore in a four-cylinder engine, one piston will always be furnishing power to the crankshaft. When six or eight cylinders are used there is actually an over-lapping of power strokes.

The orderly function of pistons in an engine to deliver power is referred to as the FIRING ORDER. This requires that the cylinders be numbered. On In-Line engines the cylinders are numbered in order from front to back, the one nearest the radiator being Number 1. On V-Type engines there is more variation in the cylinder numbering. Some number the left bank as 1, 3, 5, 7 and the right bank as 2, 4, 6, 8; on others the right bank is numbered 1, 2, 3, 4 and the left bank 5, 6, 7, 8. Find out from the owner's manual how the cylinders in the engine of your family car are numbered, and what the firing order is.

We know now that we have to get the crankshaft to turn before the engine will start and furnish power to the driving mechanism. You give it its initial start by means of an electric motor, somewhat similar to the motor in a vacuum cleaner or washing machine. It runs on electricity from the battery, activated by the starter button or ignition key, which is simply an electric switch something like a wall switch to turn on the lights.

A battery furnishes the electricity, but several other pieces of equipment are necessary for a complete ignition system. A coil and breaker points are used to raise the voltage to a high figure, and a distributor is responsible for getting the high voltage electricity to the right spark plugs at the right time to ignite the fuel-air mixture in the cylinders.

The generator is another piece of important electrical equipment. It looks something like the starting motor, but its job is the opposite. Instead of taking electricity from the battery to rotate the engine, the generator is driven by the engine and generates electric current which feeds back into the battery to keep it charged. While the car is being driven at normal speeds it supplies power to the ignition system, lights, radio, etc.

Before a car is started, one should make sure it is out of gear. Many cars with automatic transmissions will not start unless the gear is in Neutral or Park position. The owner's manual will give the proper steps in starting.

As an engine is starting the choke restricts the amount of air to fuel, giving a rich starting mixture. In most cars this automatically adjusts itself after the engine warms up. Combustion taking place in the presence of insufficient oxygen results in the formation of carbon monoxide along with carbon dioxide and water, which make up the normal exhaust gases.

CAUTION: Carbon monoxide is a poisonous gas. An engine should never be started in a closed garage.
UNIT 1, SECTION V  
THE ENGINE IN GENERAL  
LET'S ANSWER

Answer the questions by drawing a line under the statement you think is correct. Place the letter in the square at the right of the page.

1. An automobile engine is (A. an external combustion engine) (B. an internal combustion engine) (C. a two-cycle engine).

2. The crankshaft turns (A. once to every two strokes of a piston) (B. once to each stroke of a piston) (C. twice to each stroke of a piston).

3. In a single cylinder four-stroke cycle engine there is a power stroke for every (A. revolution of the crankshaft) (B. two revolutions of the crankshaft) (C. every four revolutions of the crankshaft).

4. At the start of the intake stroke (A. only the intake valve is open) (B. only the exhaust valve is open) (C. both intake and exhaust valves are open).

5. At bottom-dead-center (B.D.C.) just starting the compression stroke the (A. exhaust valve is open) (B. the intake valve is open and the exhaust closed) (C. the intake valve is closed).

6. Ignition of the fuel-air mixture takes place (A. slightly before top-dead-center "T.D.C.") (B. at T.D.C.) (C. after the piston has started down on the power stroke).


8. The two common types of cylinder arrangements used in automobile engines are (A. straight and opposed) (B. V. and in-line) (C. V. and radial).

9. In a four cylinder engine with a firing order of 1, 3, 4, 2, if piston number 1 is halfway down on the Power Stroke, on what stroke is piston number 4? (A. Exhaust) (B. Compression) (C. Intake).

LET'S DO

1. Name of engine in your family car ______________________________
   Manufacturer ______________________________

2. Number of cylinders ______________________________

3. What type of engine? "V" or "in-line"? ______________________________

4. Is the engine a two or four stroke cycle? ______________________________

5. What type valve arrangement in you engine? ______________________________

6. How are the cylinders numbered? ______________________________

7. What is the firing order of your engine? ______________________________

8. What is the compression ratio of your engine? ______________________________

9. What type of oil is recommended for your engine? ______________________________

10. How many quarts of oil does the engine hold? ______________________________

11. What grade of transmission-differential lubricant is recommended? Summer ______________________________
   Winter ______________________________

12. What is the capacity of the cooling system? ______________________________

13. If you used a different engine at club meetings, how many cylinders? ______________________________

14. What type engine? ______________________________
   What type valves? ______________________________

15. If the head is off the "Club engine," set up several problems as: When Piston No. 1 is one inch from (T.D.C.) on the Compression Stroke, what are each of the other pistons doing? That is, what stroke is each on and in what position is the Intake Valve? The Exhaust Valve? Many problems can be set up by varying the start of No. 1 until everyone is familiar with how the pistons and valves work in relating one to another.
Just as good grooming is an important factor in a person’s appearance, and can contribute to an individual’s health, so cleanliness is necessary in proper automobile maintenance. A clean, neat car helps preserve the value of your family's investment, and indicates an amount of pride in a valuable possession.

After you learn to drive you will seek permission to use the family car on occasion. One way of showing your appreciation for this privilege is to assume the responsibility of keeping the car clean. It isn't too soon to start now.

A car can be kept clean inside and out, with very little effort and relatively small expense for supplies. The owner's manual contains information about cleaning and polishing the car.

**Dust and Dirt**
The car interior can be cleaned often, even if conditions don’t lend themselves to cleaning the exterior. Empty the ash trays, glove compartment and rear window shelf regularly. Take out the removable floor mats, and use a vacuum sweeper or whisk broom to remove all dust and dirt from the upholstery, floor and trim. Wipe off the hard surfaces, like the dash-board, steering post, door edges, etc., with a damp cloth.

**Car Trunk**
Don't neglect the trunk when vacuuming. Empty out all loose items and clean thoroughly. To clean the carpet, wash with warm water and a mild detergent. Be sure it’s dry before closing the trunk.

**Upholstery and Panelling**
The upholstery and door panelling may be of leather, plastic, nylon, or other fabric. Frequent removal of dust and dirt will prolong the life and attractiveness of it, especially if constant use tends to spot and soil it. First determine the type of material it is from the owner’s manual, or the car dealer, and the nature and age of the stains. Then refer to the owner’s manual for a safe method of cleaning, or have a reliable dry cleaning establishment recommend one. There are some concentrated foam cleaners on the market, made especially for auto upholstery and fabrics. Some types of seat covers are washable, too.

One of the best ways to preserve the original beauty of a car’s finish is to keep it clean. The exterior surface will be better protected, if a garage or other storage is provided when the car is not in use. To a great extent the weather will determine how often a car should be washed to remove road grime, salt and insects. More frequent cleanings are needed in rainy, snowy or dusty weather.

**Washing**
There should be plenty of working space on all sides of the car when washing it. If it is parked on a hard surface, dust and mud will be eliminated. Avoid washing the car in direct rays of the sun, or when the metal surfaces are real hot. Do not wipe off dust or dirt from dry metal surfaces, because this may leave scratches.

Use either cold or warm water (never hot) and begin at the front of the car, working to the back until one side of the car has been covered. Then repeat on the other side. Rub a small area of the metal surface with a bath towel or wash-mitt soaked in cold water. If the car is extremely dirty, you may wish to use a mild solution of water and detergent, or a commercial car washing compound. This may remove the wax, however, and the car should be re-waxed soon thereafter.
When washing with a detergent, do not let a washed area dry, but rinse it immediately. Dead insects may be removed by saturating the area with a mild solution of water and baking soda, or a household cleaner which does not scratch. Rinse immediately with clear water. Wash the windshield with a strong detergent or household cleaner, being careful not to get any on the car finish, and rinse thoroughly. Be sure to wash the wiper blades, also.

Whitewall Tires
Use a fine grade of steel wool saturated with a solution of warm water and mild soap or detergent, or a prepared whitewall cleaner, to loosen severe road grime and curb dust from whitewall tires. Rinse immediately with clear water.

Tar Spots
When a car is driven on hot asphalt roads or over newly repaired or surfaced roads, inspect it immediately for tar spots. A liquid auto cleaner or carbon tetrachloride may be used, for if these spots are not soon removed they may discolor or take off the finish. When using carbon tetrachloride, avoid breathing in excessive fumes.

Tree Sap
In the spring particularly, trees may drop sap. If this is not removed immediately, it may discolor the paint, or cause it to come off, leaving a rust spot. The car should be washed immediately, using great care to remove all spots. If any discoloration or roughness can be detected in the finish, clean and re-wax the car. The best protection against tree sap is to park the car in a garage, not under trees.

Rust Spots
If a car is cared for properly, rust spots will seldom appear. By inspecting drain holes in rocker panels, door panels and fender wells, and opening up those that are clogged with a small wire so that any excess water can drain out, much can be done to keep these areas from rusting. If rust spots do occur on painted surfaces, the automobile dealer or a service station operator should be consulted. Most service stations offer a protective undercoating process at a reasonable price, to help preserve the value of your family's investment. This is a rust preventive type of coating, not the noise deadener type, and is available at about half the usual cost of the latter.

If rust spots occur on the chrome trim, a chrome cleaner or a glass wax can be used, following directions on the container. Rinsing with clear water is generally required with either type of cleaner.

Polishing and Waxing
Under ordinary conditions a good coat of wax will protect the car finish for several months. Before applying a polish or wax, be sure the metal surface is clean. Surveys show that paste wax, which requires some rubbing during application, serves its purpose about twice as long as does a liquid wax. When paste wax is used, a cleaner must be applied first. Liquid cleaners and waxes generally require little or no rubbing.

Should the car finish become extremely dull, a pre-wax cleaner will remove the oxidized or dull surface and help restore the original luster. A waxing job should follow. A pre-wax cleaner job should not be rushed, nor used too often, because it may remove all the paint. Re-wax at intervals of three to four months for liquid wax, and six months for paste wax.
UNIT 1, SECTION VI  CARKEEPING

LET'S DO

CHECK THESE TIPS ON YOUR CARKEEPING

1. Taking over certain responsibilities toward keeping the car clean, inside and out, can possibly speed the time when you will be allowed to learn to drive. (Agree) ______ (Disagree) ______

2. Proper care of the interior is as important as the care of the exterior of the car (True) ______ (False) ______

3. In cleaning the interior, it is logical to start with the glass. (True) ______ (False) ______

4. What kind of equipment can best be used in cleaning the interior of the car? ________________

5. Since the interior of the trunk is seldom seen, it is not necessary to consider it as part of the cleaning job. (Agree) ______ (Disagree) ______

6. The same cleaning process and equipment should be used for all types of upholstery and floor covering. (True) ______ (False) ______

7. Cars should be washed only on warm sunny days in the shade. (True) ______ (False) ______

8. The first step in washing a car is to wipe off all dirt and dust with a dry cloth. (True) ______ (False) ______

9. Using a strong detergent will speed up and improve the washing process. (True) ______ (False) ______

10. Dead insects can be removed with a mild solution of baking soda and water. (True) ______ (False) ______

11. Tar spots and tree sap may permanently damage the surface. (True) ______ (False) ______

12. Rust spots harmful to both chrome and painted surfaces may be removed with any chrome cleaner. (True) ______ (False) ______

13. Waxing the exterior of the car is necessary when it is washed frequently. (Agree) ______ (Disagree) ______

14. A paste wax will provide a more lasting finish than liquid polishes. (True) ______ (False) ______

15. Since most waxes and polishes are very similar, it is not necessary to always read the directions. (True) ______ (False) ______

LET'S ANSWER

Preserving your car makes sense because it saves money. Whether you use a pickup, station wagon, or car, take time to take care. As you complete one of these topics, check the answer as indicated.

1. What type of vehicle are you using? __________________________

2. Is your car: (one color) (two-tone) (three-tone) ______________________

3. Clean the interior of the car:

   What parts of the interior did you clean? __________________________

   What equipment did you use? __________________________

   What stain spots did you find? __________________________

   What materials did you use? __________________________

   How did you remove stain spots? __________________________

   How did you clean soiled upholstery? __________________________

4. Wash the car:

   How did you clean the glass? __________________________

   Was it necessary to remove dead insects from the front? __________________________

   Explain procedure used __________________________

Did you find tar or rust spots on the metal surface? __________________________

How did you remove them? __________________________
5. Did you clean the trunk and trunk channel? 
   How did you repack it? 
6. Polish or wax the car:
   How did you prepare the metal surface for waxing?
   What type of wax (liquid or paste) did you use?
   Why?
   How did you apply the wax?
7. Describe the most difficult job in cleaning the car 

8. Record of CARKEEPING jobs I performed:

<table>
<thead>
<tr>
<th>Date</th>
<th>Washed Exterior</th>
<th>Removed Tar Spots</th>
<th>Removed Tree Sap</th>
<th>Removed Rust Spots</th>
<th>Polished or Waxed</th>
<th>Cleaned Interior</th>
<th>Cleaned Upholstery</th>
<th>Cleaned Trunk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Example:</td>
<td>Jan. 2</td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Did you demonstrate CARKEEPING before others? (Yes) (No)
10. What was the topic of your demonstration?
11. List the main points in your demonstration
UNIT 1, SECTION VII

What does it cost to operate and maintain a car? This question is asked frequently and the answer depends on a great many things.

The make and model of the car and its age must be considered. The section of the country in which it generally is used, how fast it is driven, and the driving practices of the operator are others. Also, there are fixed costs like insurance, license fees, and depreciation. Depreciation means the decrease in value which occurs as the car gets older.

Items called variable costs also enter the picture. These cover gasoline and oil, maintenance and repairs, and tires.

Much information about costs is given in a leaflet "Your Driving Costs" published by the American Automobile Association. The leaflet gives figures based on national average costs computed for a new 8 cylinder, hardtop sedan equipped with standard accessories, automatic transmission, power disc brakes, radio and power steering.

The figures in the leaflet are grouped under two headings, "Variable" and "Fixed" costs. Here is what they show:

<table>
<thead>
<tr>
<th>Variable Costs</th>
<th>Average per Mile (in cents)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gasoline and oil</td>
<td>4.82</td>
</tr>
<tr>
<td>Maintenance</td>
<td>0.97</td>
</tr>
<tr>
<td>Tires</td>
<td>0.66</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>3.45 cents</strong></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fixed costs</th>
<th>Average per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fire &amp; Theft insurance ($50 ded.)</td>
<td>$53.00</td>
</tr>
<tr>
<td>$100 ded. collision ins.</td>
<td>141.00</td>
</tr>
<tr>
<td>Property damage &amp; liability ins. ($100,000, $300,000 &amp; $25,000 limits)</td>
<td>189.00</td>
</tr>
<tr>
<td>License &amp; registration</td>
<td>30.00</td>
</tr>
<tr>
<td>Depreciation</td>
<td>773.00</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$1,186.00</strong></td>
</tr>
<tr>
<td><strong>$3.25 a day</strong></td>
<td></td>
</tr>
</tbody>
</table>

Using the above figures, variable costs 6.45¢ per mile and fixed costs of $3.25 per day, and given the total miles driven during the year, it is easy to compute total annual costs of operation of a car and the average cost per mile driven. The average motorist drives 10,000 miles per year. Note how the cost per mile varies in the following examples:

- 10,000 miles at 6.45¢ ........................................... $ 645.00
- 365 days at $3.25 ............................................. 1,186.00
- Total annual cost .............................................. $1,831.00
  $1,831.00 - 10,000 = 18.3¢ per mile

- 20,000 miles at 6.45¢ ........................................... $1,290.00
- 365 days at $3.25 ............................................. 1,186.00
- Total annual cost .............................................. $2,476.00
  $2,476.00 - 20,000 = 12.3¢ per mile
You must remember, of course, that the costs listed here are based on a national average. Actually, there are great differences in costs in different sections of the country because charges for insurance and for license fees are not the same everywhere.

This section of the Automotive Care and Safety Project includes forms which will help you keep track of the cost of operating and maintaining a car.

Form No. 1 provides a Maintenance Schedule for a car. To protect the investment, one should see that items of maintenance are performed regularly, as recommended by the owner's manual. Form No. 1 will help see that this is done.

Form No. 2 will show the monthly cost of operating and maintaining a car.

Form No. 3 shows at a glance what kind and amount of insurance coverage there is; the company it is with, and the cost. This form, when filled in, also serves as a reminder for renewing the insurance coverage.

### MAINTENANCE SCHEDULE

**Check Each Item When Completed**

<table>
<thead>
<tr>
<th>Item</th>
<th>Should be serviced every:</th>
<th>Enter your mileage here when servicing is complete</th>
<th>Next servicing due at:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safety Inspection, brakes, lights, steering, horn</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Lubricate</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Chassis</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Change Oil</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Clean Air</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Filter</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Check Transmission</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Oil Level, automatic and conventional</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Inspect Tires for pressure &amp; bruises</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Rotate Tires</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Replace Oil Filter element</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Clean Spark Plugs</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Check Brake Adjustment</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Drain Transmission</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Repack Front Wheel Bearings</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
<tr>
<td>Repack Universal Joints</td>
<td>---- miles</td>
<td>---- miles</td>
<td>---- miles</td>
</tr>
</tbody>
</table>

Form No. 1
<table>
<thead>
<tr>
<th>Date</th>
<th>Speedometer Reading</th>
<th>Gasoline</th>
<th>Oil</th>
<th>Service Charge</th>
<th>Repairs</th>
</tr>
</thead>
</table>
|      |                     | Gals.    | Qt. | Cost           | G-grease
|      |                     | Cost     |     | Cost           | W-wash
|      |                     |          |     |                | Cost    |
|      |                     |          |     |                | Kind    |
|      |                     |          |     |                | Cost    |

<table>
<thead>
<tr>
<th>Monthly Totals</th>
<th>Gals.</th>
<th>Qts.</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Cost</td>
<td>$</td>
<td>$</td>
</tr>
</tbody>
</table>

Speedometer Reading Last Day of Month
Speedometer Reading First Day of Month
Miles Traveled
Miles per Gallon of Gasoline (divide total miles driven by total gallons of gasoline consumed)

Cost of Operation this Month (Totals of all columns)
Monthly Charge for Insurance (1/12th of total annual premium—from Form No. 1).
Total Expense this Month
Cost per Mile this Month (divide total cost by total miles driven).
INSURANCE CHARGES

<table>
<thead>
<tr>
<th>Kind of Insurance</th>
<th>Company</th>
<th>Date of Renewal</th>
<th>Amount of Protection</th>
<th>Annual Premium</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liability (bodily injury and property</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>damage to others)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medical Payments</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Personal Accident</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Comprehensive (Fire, Theft, Glass</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Breakage, etc.—loss to own car)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Collision (damage to own car)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total Annual Premium

"GET WITH IT!" HELP SAVE FUEL

Even before you start to drive, you can help cut down the cost of operating the family car. Consider these facts and plan ways you can suggest fuel savings to your family.

Fuel costs have jumped dramatically in the past few years. In only six years, the cost of gasoline and oil has gone from 2.65¢ per mile to 4.82¢ per mile. That may not seem like much until you multiply the number of miles the average car is driven each year by the increase of 2.19¢ per mile. $219 extra!

Every week, individual Americans use over 897 million gallons of gasoline. Every day 58 million workers use their car driving to and from work. Of these, 40 million drive alone. They consume 290 million gallons per week.

Family business trips—shopping, trips to the doctor, etc.—use up 225 million gallons per week. Family social and recreational activities, including vacations, are responsible for the use of an additional 382 million gallons.

As an individual or club project, let's take a look at what you can do to help cut down gasoline usage. First, are there workers in your families who drive to work? Take the lead here and suggest car pools or the use of public transportation where a bus or train is available.

The average car owning family makes five business trips per week, each 11 miles long. Here is a place where cutbacks should be easy. Start by combining shopping trips. Try to handle errands in one trip and, if possible, at one shopping center. Neighborhood car pooling for shopping, trips to and from school, athletic events, etc., will save gasoline and provide welcome company.

The average family takes 3.5 pleasure rides, visits to friends and relatives and other social or recreational trips per week. This is an area where you can suggest real savings in fuel consumption. Spur-of-the-moment rides can be cut down and careful vacation planning are just two ways to save gasoline. You and your club members can suggest several more.

For example, air conditioning adds .20 cents per mile and $.20 per day to driving costs. An early start in hot weather can reduce the need for the use of this equipment. This will also avoid heavy traffic and stop and go driving.
## UNIT 1, SECTION VII  CAR COSTS AND RECORD KEEPING

### LET'S ANSWER

Answer "True" or "False" to each of the following questions.

<table>
<thead>
<tr>
<th>Question</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The miles per gallon on a tank of fuel is a satisfactory guide to the cost of operation of your car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Variable costs are computed on the basis of average driving speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Insurance is an item of fixed costs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Systematic servicing of spark plugs will save money in the long run</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. The miles per gallon for a period of a month, including other rural and town driving, is the most accurate picture of auto efficiency</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Liability insurance protects against damage to your own car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. The term &quot;comprehensive&quot; includes fire, theft, tornado, etc.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Liability insurance rates are based on the age of a car</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Are there charges other than those discussed, such as taxes, which apply to your particular area? Outline them</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Check the amount and type of insurance being carried on your family car</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

List below.
Driving is a privilege!

It is a privilege granted only to those who can
demonstrate that they are qualified. It is not an
inherent right such as those rights, for example,
guaranteed to you by the Constitution.

A driver’s permit, or license, will be issued to you
by the state only when you reach the legal age and
pass certain examinations. These tests include an
eye examination, your ability to operate a motor
vehicle, and your knowledge of traffic laws. Most
states also require you to get a temporary permit
and to be accompanied by a licensed driver while
you are learning to drive.

When you become eligible, you can apply for your
driver's permit at the nearest office of the division
or department of your state government which-
handles motor vehicle matters. You can get
detailed information about applying from your
local police station.

The system of driver licensing and the other laws
concerning motor vehicle use and ownership, are
established for the mutual protection of all high-
way users. They are designed to help you and the
millions of other American motorists enjoy safe
and efficient travel. Called laws, ordinances and
regulations, they make up the traffic codes of
states and cities. The purpose of these motor
vehicle regulations is the same as that of the laws
and rules you meet daily in other phases of your ac-
tivities. These laws reflect the desire of a majority
of citizens to make motor vehicle use as safe as
possible and, at the same time, to give you your
traditional American freedom in a way that is fair
to all.

Failure to follow the traffic regulations can have
fatal results. If you violate the laws, you also must
be prepared to accept penalties, including the loss
of your privilege to drive.

For your own protection and that of others, you
will want to learn to observe strictly all motor
vehicle laws. These laws are sometimes called
“Rules of the Road.” They are the rules which
govern your actions each time you drive or walk on
the highway. Rules of the Road are not com-
plicated; they simply set forth the courtesy and
respect you normally should show others who share
the roads and streets with you.

The basic purpose of motor vehicle laws is the same
everywhere. Unfortunately, however, they are not
yet uniform in every state.

Rules of the Road cover all situations which might
occur while you are driving or walking. Some of
these, for example, are accidents, driving on the
right hand side of the road, overtaking and pass-
ing, turning movements, pedestrian and vehicle
right-of-way, speed, traffic signs, signals and
markings, and what to do in the event you are in-
volved in an accident. When you are a driver you
will realize that it is your responsibility to know
the Rules of the Road. Therefore, as a pre-driver it
is to your advantage to become acquainted with the
Rules of the Road, so that you will have respect for
them by the time you are a licensed driver.
All states require drivers to be financially responsible in the event of an accident. This requirement is covered by the safety responsibility law, or as it is called in some states, the financial responsibility law. Regardless of its name, this law requires all drivers involved in an accident to be able to pay damages. If, after an accident in which you are at fault, you are unable to show proof that you can pay damages, your privilege of driving will be taken away. This privilege — or in most states, your driver’s license — will not be reinstated until you pay any damages assessed against you.

Provisions of the safety responsibility law may be met by posting money or some other form of wealth with the state, or by proving you are covered by an automobile public liability and property damage insurance policy.

The basic purpose of the safety responsibility law is to protect innocent drivers against losses resulting from an accident involving, or caused by, another vehicle.

Whenever you become the owner of a motor vehicle there are certain other laws you must follow, in addition to those which apply to you as a driver. These include regulations concerning title and registration of the vehicle.

Title is the legal ownership of a motor vehicle. It is shown in various ways, depending on state requirements. Most states issue a "certificate of title," which establishes the owner's interest in the vehicle. It also helps reduce theft of cars, because the certificate, or other document required by the state, must be transferred when a motor vehicle is sold.

All states require registration of motor vehicles annually. To register a motor vehicle, a person must produce evidence of ownership. The primary purposes of registration are to collect a tax from the owner for the privilege of using the highways, and to provide a means of identification. This is shown by the registration card and license plate or plates issued each owner of a registered motor vehicle.
UNIT 1, SECTION VIII TRAFFIC CODE AND YOUR FUTURE RESPONSIBILITIES

LET'S DISCUSS

The following seven cases are presented for discussion. Each asks the question: Who is right; who is wrong? What is your decision or opinion? (Cases 1 through 7 are to be introduced by the leader.)

Case I
Car A is driving 40 miles per hour on the inside of a four lane highway which has marked lanes. You approach from the rear and want to pass. After following Car A for some time, you see that the driver is not going to give way to the right, so you start passing him on the right.

Car A then proceeds to steer to the right, colliding with your car. Who is right; who is wrong?

Case II
You are driving west on U.S. 40, west of a city, on a four-lane divided highway at 45 mph. A school bus going east stops to unload children. As soon as you see the flasher lights on the bus you come to a sudden stop without giving a signal.

The car following you cannot stop and collides with your car. Who is right; Who is wrong?

Case III
Car A suddenly slows down to turn to the right without giving a signal. Car B is following but cannot stop, so he swerves into the left lane to avoid Car A and collides head-on with Car C coming in the opposite direction at 68 mph. Who is right; who is wrong?

Case IV
You approach a through highway and stop in obeying a stop sign. You see a car coming, but he is way down the road. So you proceed.

The car you saw collides with you and the investigation of the accident shows that this car was traveling at 75 mph. Who is right; who is wrong?

Case V
You approach from the rear and try to pass a car traveling 20 mph, but cannot. Your blood pressure climbs to about 250, you call the other driver names that aren’t fit to print and you think you’ve about had it, when you take a chance and try once more to pass him.

You collide with a car coming from the opposite direction. Who is right; who is wrong?

Case VI
It is 11 P.M. and raining hard. A farm truck without a tail light is driving ahead of you, but you don’t know it. You are driving at 45 mph, on a road with a 50 mph speed limit.

Suddenly you are blinded by the lights of an approaching car which did not dim his lights, and you collide with the truck. Who is right; who is wrong?

Case VII
You are involved in an accident which resulted in more than $100.00 in property damages. You call the state patrol and they investigate, making a full report.

Two months pass by and you receive notice that your driver’s license has been suspended for failure to report the accident. Who is right; who is wrong?

In all of these cases the question is asked: “Who’s right and who’s wrong?” What is your opinion?

LET'S ANSWER AND DISCUSS

Please mark (T) True, or (F) False, or make the proper choice, before discussing it together:

1. A temporary permit entitles you to drive a car as you desire ............................................................
2. A temporary permit is good for only 60 days ...........................................................................................
3. Once you get your operator’s license, you are set for life .....................................................................
4. A driver’s examination is simple — everyone who takes it passes it .....................................................
5. Drivers under 21 years of age and their parents are jointly responsible for damages in case of automobile accidents. .............................................................................................................
6. Your driver’s license can be suspended if you are found guilty of reckless driving ..............................
7. When you drive an automobile, in case of an accident you must be able to pay damages if you are at fault ..............................................................................................................................
8. At intersections where stop signs or signals are not erected, who has the right-of-way? (A. Vehicle approaching on right) (B. Vehicle approaching on left) (C. Neither vehicle) ..................
9. A red flashing light at the intersection means the driver (A. Must stop and yield right-of-way) (B. May pass through with caution without a stop) (C. Must stop for at least 10 seconds) ........
10. When entering or crossing a highway from a farm driveway, the driver must (A. Look both ways and proceed with caution, stopping only if necessary) (B. Approach fast so he can cross in a hurry) (C. Stop and yield the right of way) ...........................................................................
11. The major responsibility for reducing traffic accidents rests with (A. Police officers) (B. Our courts, which should impose larger fines) (C. The drivers of cars)  

12. A pedestrian is crossing the street in a crosswalk on a green light, but the signal changes while he is still in the street. Who must yield the right-of-way? (A. The motorist) (B. The pedestrian) (C. Neither)  

---

**LET'S DO**

Do individually, or as a group, and report to your club.

1. Obtain driver's handbook from state driver licensing authority and learn all the Rules of the Road for your state.
2. Demonstrate to your club the hand and arm signals used in your state for driving.
3. Sketch the traffic signs, signals and markings common in your state.
4. On trips out of state, observe traffic signs, signals and markings that are different from those in your community. Make a list of these differences for club discussion.
5. Investigate types of insurance and their cost.
6. Station yourself at a busy intersection and list any violations of pedestrians and drivers that you notice. Return to your meeting place and discuss the violations.
7. Visit a traffic court (as a spectator, not a violator) and observe the proceedings.
8. Try a new method of having group discussion in your club. Below is a brief illustration of a situation involving a group of teenagers. You can develop this further and then take about 10 minutes to dramatize the situation. Following that, discuss the situation together to try to arrive at your own conclusions about the privilege of driving and the responsibilities of a driver.

A group of five or six teenagers are having a Coke after school in a local store. Bill Phillips, one of the boys is saying:

"You know, we were talking about highway safety this afternoon in Social Studies. We really got into a hot discussion when Tom Peters said he thought that driving is a privilege one earns. I can't quite understand that. It seems to me that since our family cars are paid for, and the roads are paid by taxes from everybody, wouldn't you say it is a right that we all have, not a privilege?"

Kay Hansen, interrupted,

"I was there, too. That remark started me thinking about driving and the difference between a right and a privilege. We have rights in free speech and other things, but driving seems a little different to me. Cars are so powerful today, somebody has to see to it that the lives of all the people are protected."

"Well we get training all through school about what our rights are and what the rights of all people are, and many things we can do are really privileges since all people must be considered," commented Dick Johnson. "You know we don't live in this world by ourselves, and everybody is safer when each considers the other fellow."

There's the introduction. Now add to the illustration as you wish and try acting out the scene to stimulate thinking and discussion in your group.
If you were to stop the next 100 cars passing you on the highway, you would find that one in every five had defective safety equipment, according to a survey made in the National Vehicle Safety Check program recently. One out of every five, or approximately 15,720,000 cars and trucks in use at the time of the inspection, were unsafe. This estimate is based on the nearly 3,500,000 vehicles checked.

On passenger cars, lights, mostly rear and stop, and exhaust systems were the principle items needing attention. These were followed in importance by front turn signals, tires, and brakes.

On trucks, lights, mostly rear and stop, also ranked first as items needing attention. Second in importance on trucks were rear turn signals, followed by exhaust systems, brakes, front turn signals, and glass.

For both cars and trucks the items needing attention in order of the percent of vehicles with each defect, were: rear and stop lights, front lights, exhaust systems, front and rear signals, tires, brakes, glass, windshield wipers and washers, horn, steering, and rear-view mirror.

You as a 4-H Club member have an opportunity to learn about the vehicles used by your family and can make sure that they meet good safety standards. Let's look at some of the safety check items and see what they mean to you.

**Brakes**

Brake failure is one of the great causes of highway accidents. This can be easily seen when one realizes that at 50 miles per hour one needs 25 times more stopping distance than is needed at 10 miles per hour. Almost 50 percent more distance is needed than that at 50 mph; at 80 mph, over two and a half times that at 50 mph.

What happens is that the car's energy increases as the square of its speed. The faster you go the harder it is to stop. If you double your speed, you need four times the distance for stopping; if you triple the speed, nine times the distance for stopping.

Things club members can be alert for, when checking over the family car, are how far the pedal moves before the brakes seem to be taking effect, whether the brakes grab, whether there's a scratchy sound when they're being applied, or whether there's a mushy pedal which indicates air or moisture or both in the hydraulic lines.
Exhaust
Almost everyone is familiar with the exhaust system and the dangers of carbon monoxide, if it seeps into a closed car. Yet often we fail to take time to check the system to see that it is tight and free from leaks. Usually a noisy exhaust system, unless it is a special "hotrodder's" delight, indicates trouble.

In this Section you will have an opportunity to learn of the many safety checks you can make to improve your and others’ safety. We should be continually alert to the safety checks we make, and equally alert to having your car checked by a professional at least twice a year.

Vision
In the inspection report you noticed that defective front and rear lights ranked high in both cars and trucks. These alone are the cause of many accidents, since lighting defects make it hard for drivers to see, or for their cars and trucks to be seen at night.

Many drivers will be alert to the need for proper lights, but overlook the fact that improper care of their car can help reduce their vision. Dirty, fogged windows, stickers and objects which interfere with vision, wiper blades that need renewing, and the biggest obstacle of all, improperly adjusted headlights, cooperate to make poor vision one of the major causes of accidents.

Tires
With today’s high speed superhighways, proper checking of the tires becomes increasingly important. High speed causes dangerous distortion in tires. When tires are over- or under-inflated the tread becomes stretched and distorted. Excessive heat builds up in flexing tires, often causing failure. It takes but a few moments to see if the tires are properly inflated, have ample tread, are free of bulges, cuts, breaks, and uneven wear. The safety check can save you money, possibly your life.

Wheel alignment is also important to the life of your tires. A competent tire serviceman should align both front and rear wheels.

ZERO IN ON THESE TARGETS

SAFE OPERATING PROCEDURES
SAFE OPERATING CONDITION
SAFE SERVICING
UNIT 1, SECTION IX  
CAR INSPECTION — SAFETY CHECKING A CAR

LET’S DO

Ask your parents to help you complete this Safety Check Sheet on your family car.

SAFETY CHECK SHEET

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YES  NO.

EXHAUST SYSTEM AND MUFFLER
☐ ☐ Tight - no carbon monoxide seepage into car through holes or leaks.
☐ ☐ Quiet.

WINDSHIELD WIPERS
☐ ☐ Dependable - work when needed.
☐ ☐ Live, flexible rubber blades which wipe clean.
☐ ☐ Run at an adequate and constant speed.

GLASS
☐ ☐ Free from cracks, chips, discoloration, dirt that obscures vision.
☐ ☐ Free from unauthorized stickers and objects that obscure vision.
☐ ☐ Clean and free of dirt film.

HORN
☐ ☐ Sounds off on cue.
☐ ☐ Loud enough to be heard 200 feet away - but not so loud that it's a nuisance.
☐ ☐ Operates from any part of ring or button.

OTHER
☐ ☐ Seat belts fastened to car structure.
☐ ☐ Flashlight in car.
☐ ☐ No objects on back seat that obstruct vision.
☐ ☐ Defroster works properly with good flow of air.
☐ ☐ Sun visors work freely, yet stay as positioned.