

Automotive Fourth Year

Module 1 Mag-oto-oto Ka Na! Fundamentals of Automotive

What this module is about

Hello, friend! How are you? Before you start learning the basics of automotive, keep in mind that this module is designed to stimulate your mind and guide you in the fundamental aspects of automotive as well as the safety shop practices.

Although, development of your knowledge, skills and efficiency must be given emphasis, you should be aware that your interest to learn this module offers opportunities for the development of your initiative, responsible choices and self-reliance.

Learning the basic shop practices and fundamental aspects of automotive is easy. It increases your confidence in the selection of tools, equipment and the different components of vehicles. It helps you also prevent possible accidents.

After going through this module, you are expected to:

1. Identify the fundamental aspects of automotive and the various safety shop practices.
2. Observe safety shop work practices.
3. Follow procedures diligently and accurately.

PRETEST

Test I

Directions: Below is a set of questions for you to answer.

This is not a graded test. It will just test your level of knowledge of the fundamental aspects of automotive and the basic safety practices in the shop. So feel free to answer all the items in this test by encircling the letter of your choice.

1. Exhaust gases contain harmful fumes that are:
 - a. cardinal
 - b. eternal
 - c. fatal
 - d. vital

2. When spillage of oil, grease and other oil containing solvents happens, wipe it:
 - a. afterwards
 - b. immediately
 - c. tomorrow
 - d. none of these

3. When operating electronic, hand-driven, or electric operated machines, always consult your:
 - a. classmate
 - b. friend
 - c. manual
 - d. teacher

4. Placing sharp objects in your pocket while working should:
 - a. always be done
 - b. never be done
 - c. sometimes be done
 - d. be totally done

5. Placing jack-stands or supports under the solid parts of a vehicle when jacking-up ensures:
 - a. ability
 - b. capability
 - c. nobility
 - d. stability

6. A feeler gauge is placed between:
 - a. solid parts
 - b. hollow parts
 - c. gap
 - d. space parts

7. In using a hacksaw, apply enough _____ to ensure cutting.
 - a. sideward pressure
 - b. backward pressure
 - c. toward pressure
 - d. upward pressure

8. To measure the tightness of a bolt or nut, use:
 - a. torque wrench
 - b. pipe wrench
 - c. adjustable wrench
 - d. open wrench

9. Which of the tools is best in loosening and tightening bolts and nuts?
 - a. open-end wrench
 - b. box-end wrench
 - c. socket wrench
 - d. pipe wrench

10. It is a special type of screwdriver used in difficult areas:
 - a. phillips
 - b. flat-tip
 - c. clutch tip
 - d. offset

Test II.

Directions: Identify the following pictures. Write only the letter of the correct answer.

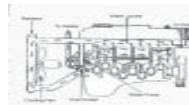
1. radiator

a.



2. hacksaw

b.



3. chisel

c.



4. connecting rod

d.



5. wrench

e.



Lesson 1

Basic Shop Work Practices

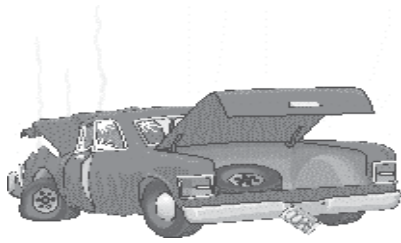
Safety first as the common saying goes, in every work endeavor “an ounce of safety is worth than tons of cure.” Accidents occur but they can be avoided. Carelessness and passivity in using wrong tools and procedures can cause your life.

It is very important that you acquaint yourself with vital and various precautionary measures in doing shop work to avoid accidents. Here are some:

1. Never smoke or come near the flame when handling any type of solvent. They are highly flammable.
2. Wipe-out immediately any spillage of oil, grease and other oil containing solvents to avoid slippage.
3. Wear protective clothing, goggles or dust mask when grinding, chiseling, welding, wire brushing and painting.
4. Always consult the teacher when operating any electronics, hand driven or electric operated machines.
5. Fully concentrate on your job at the same time be aware of what is happening in your surroundings.
6. Putting sharp objects in your pockets such as screwdriver, scissors or knife should never be done while working. Use proper tool dispenser.
7. Always place chock of woods on the front-end or rear-end of wheels to avoid slippage while jacking-up the vehicle.
8. Place properly jack stands or support under the solid portion of a vehicle when jacking-up. This ensures stability against unnecessary movement.
9. Do not play or do any unnecessary activities under or around the vehicle while working. Many untoward incidents take place because of failure to observe precautions.
10. Use the right tools and equipment in the right and appropriate job. Use of inappropriate tools and equipment will do more damage to automobile parts and cause body injury.
11. When running an engine in a garage, be sure that the exhaust fan is working and windows open to ensure good ventilation. Exhaust gases contain harmful fumes that can damage your body totally.



12. Do not stand in front of the vehicle when start-testing. Be sure that the hand brake is applied and the transmission is in a neutral position. Many lives have died by disregarding this simple rule:



“An ounce of safety is worth tons of cure.”

Activity 1

Report to your teacher. Under his close supervision, demonstrate one out of three safety shop work practices.

1. Wear protective goggles while grinding or chiseling.
2. Place chock of woods at the front-end or rear-end of the wheels while jacking-up.
3. Use tools in loosening and tightening screws.

Self-check:

Directions: Fill-in the blanks with the word or group of words that will complete the statements.

1. Exhaust gases contain harmful fumes that are _____.
2. Putting sharp objects in your pocket while working should _____.
3. When spillage of oil, grease and other oil containing solvents happens, wipe it _____.
4. Placing jack stands or support under the solid portion of a vehicle when jacking-up ensures _____.
5. When operating any electronic, hand-driven or electric operated machine, always consult your _____.

For the correct answers, turn to the key to correction at the end of this module. Review the items not correctly answered and find out what your problem is.

Lesson 2

Fundamental Aspects of Automotive The Basic Tools and Equipment in Automotive

Do you wish to increase your knowledge of automotive? If so, there is a need for you to study this lesson because this will provide you with understanding and skills on the basic tools and equipment in automotive- its simple operation and how these tools and equipment are used.

Automotive Tools and Equipment

Tools must be of much strength, usually made of high strength alloy steel. They should be light and easy to use, efficient and properly designed for the particular job. Good tools are good investments.

A. The Basic Automotive Tools

1. Hammers - Hammers are of different kinds according to their use. Ball peen hammers are generally used in pounding heavy metals and their weights range from a couple of ounces to several pounds.

Soft Hammers – are usually made of brass and plastic. It is used in place of the ball peen hammer which mars the surface of soft metal.



Caution: Keep the hammer handle tight in the hammer head. Loose hammer heads can fly and cause injury when they strike people.

2. Chisels - Chisels are used to cut thick metals. Sometimes it is used in cutting objects when space is so tight that normal cutting using the hacksaw can not do. Chisels come in several sizes and types. The flat cold chisel is used for general cutting. Special chisels like the diamond point chisel is used for cutting V- grooves and square corners. The, cape chisel and round chisel are used to cut keyways and semi-circular grooves.

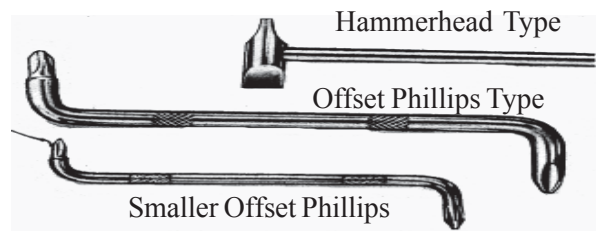


Caution: To reduce the danger of mushroom head particles flying around, wear protective goggles when using a chisel. Keep the cutting edge sharp.

3. Screwdriver - Screwdrivers are generally used to loosen or tighten screws. There are different kinds such as the flat tip or, standard tip screwdriver which is used for single slot or minus slot screw

heads. The phillips tip screwdriver is used for cross slot or plus slot screw heads. A clutch tip screw driver has a butterfly design on its tip.

Other types of screwdrivers such as the offset and the hammerhead come in long, thin shanks and used in difficult areas.



Caution: Do not use screwdriver in prying.
Do not use screwdriver in chiseling.
Do not overgrind the tip of the screwdriver.

4. Pliers – Pliers are used to hold and grip objects such as wires, bolts, nuts and sheet metals. Pliers come in different forms and designs.

The following are pliers usually available in shops and hardware stores.

- a. Needle Nose Pliers- It is used in gripping, removing and replacing small objects such as screws, needle bearings, thin spring wires and nuts.



- b. Mechanical Pliers – These are used to hold light objects such as nuts and bolts. They can also cut and bend wires and thin sheet metals. They have a slotted segment on the nose for holding and bending purposes and the oblong or semi-elliptical shape of its jaws, for gripping purposes.

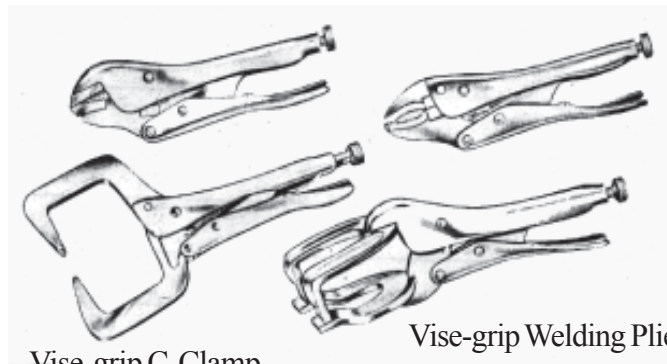


- c. Electrical Pliers- These are generally used in electrical work. It has different kinds such as long nose pliers which is used to hold light objects such electrical wires and insulators, small screw and nuts and for removing cotterpins.

Another type is the side cutter pliers which is used to cut light in order to moderate wires used in automotive.

Another useful type is the wire stripper plier used in removing or stripping insulators. Some wire stripper are equipped with a crimping portion which is used to tighten terminal holders in ignition cables and bayonet type terminals.

5. Vise-Grip Pliers – this is also called “lock grip plier” and its main purpose is for gripping and locking. It is especially designed to hold round objects and has adjustable jaws to fit different sizes of pipes, rods, bolts, nuts and thick sheets of metal. It comes in different forms and styles.



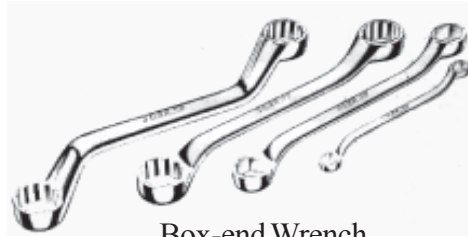
Vise-grip C-Clamp

Vise-grip Welding Pliers

Caution: Pliers should never be used in place of the wrench. Use the pliers designed for use in specific jobs.

6. Wrenches - Used to loosen or to tighten bolts, nuts and the wrench is of different sizes and kinds. Following are the common wrenches used:

- a. Box end wrench - it is an excellent tool due to its gripping effect on all sides of bolts and nuts. It is designed with either a 6 or 12-point opening. The 12-point opening box wrench reduces the chance of slipping, with less damage to the bolts and nuts.



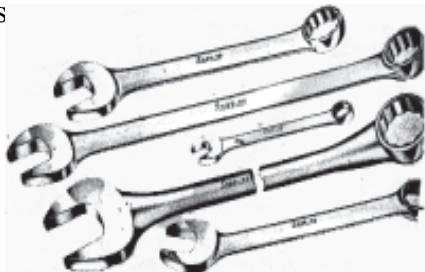
Box-end Wrench

- b. Open-end wrench – This type is also used to loosen and tighten bolts and nuts, but not as good as the box-end wrench. It is likely to slip due to heavy pull because it grasps the nut on only two flat sides.



Open-end Wrench

- c. Combination wrench – It is a very convenient tool because it has the same size on both ends with a box-end head on one end, and an open-end on the other. It can be used both for breaking loose and final tightening purposes.



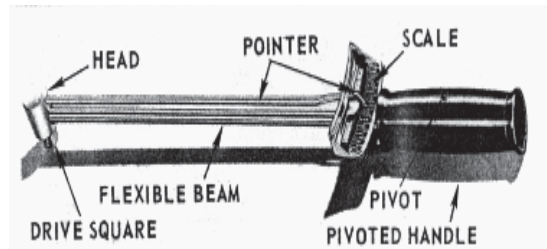
Combination Wrench

- d. Socket wrench - This is the fastest type among the other wrenches, (except the pneumatically operated) and in most instances, it is very convenient. Sockets are available in 6-point and 12-point double openings. The 1/4 in, 3/8 in, 1/2 in, and 3/4 in drives cover a wide range. The drive refers to the size of the square hole into which the socket handle fits. The larger the drive, the heavier and bulkier is the socket.



Socket Wrench

- e. Adjustable wrench - This is a handy wrench which can be adjusted in size. It is a door wrench for use in most jobs because it tends to slip. To use, adjust the jaws firmly. Be sure that when tightening in a clockwise direction, the pull on the handle is toward the bottom side.
- f. Torque wrench - This is a helpful tool in measuring the exact tightness, (torque) applied in bolts and nuts. The torque wrench has a decal that contains the unit of tightness in foot-pounds/kilogram-meter and a needle indicator that points to read the tightness applied on bolts and nuts. Without the use of the torque wrench, improper and varying tightness on bolts and nuts can cause distortion.



Torque Wrench

- 7. Feeler gauge - This is a measuring tool specially designed to check clearances in thousandths of an inch. It is composed of thin strips of hardened and ground steel and is inserted between two parts to check gaps and clearances like valve clearance and spark plug gaps.
- 8. Hacksaw - It is an excellent tool for cutting bolts, tubings, thick metals and iron bars. Hacksaw blades generally come in 14, 18, 24 or 32 teeth per inch types. The 14-tooth blade is used for cutting fairly thick articles and the 18-tooth blade handles work of medium thickness. For brass, copper medium tubing and heavy sheet metal. The 24 tooth blade is good enough for use, whereas a 32-tooth blade is used for thin sheet metal and thin wall tubing.



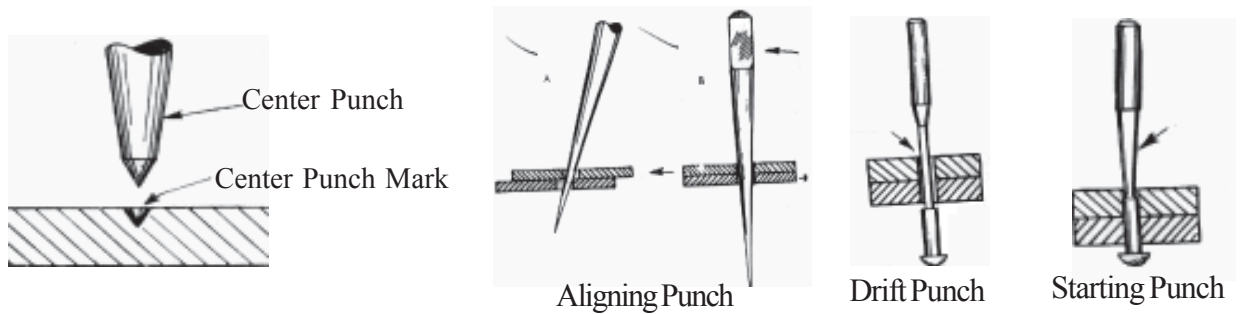
Hacksaw

How to use the Hacksaw

1. Grasp the hacksaw frame firmly, one hand on the grip and the other on the front.
2. To ensure cutting, apply enough forward pressure.
3. Raise the blades slightly on the return stroke.
Note: Never start cutting on the sharp edge. This may chip the teeth. Be sure that objects to be sawn are held firmly.
4. Apply another forward pressure.

Note: Be sure that saw speed will produce 40-50 strokes per minute (forward stroke). Apply a little oil to increase the life of the hacksaw blade.

9. **Punches**—Common punches usually come in different forms and applications. The common punch available at the shop is the center punch. It is made of high grade tool steel, tapered in a V-shape form and is used for marking parts to be drilled. The other one is the aligning punch which has long tapered body and ends in a sharp point. This enables the two corresponding holes to be aligned. Another common punch available in the shop is the starting punch which is tapered to a flat tip and is used in starting to punch out pins. After the pin has been started, a drift punch completes the series of tasks by completely driving out pin or rivet because of its smaller diameter and long reach body.



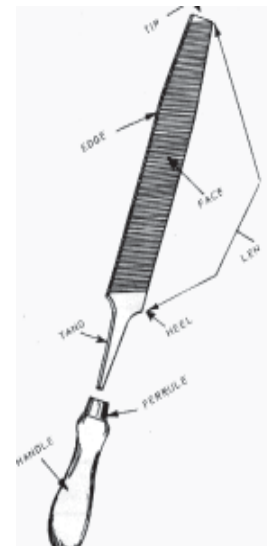
10. **Files** - Files are used to smoothen rough and uneven surfaces. They are also used to shape objects and sharpen other tooth cutting tools such as wood saws the single-cut file has a series of cutting edges parallel to each other, whereas a file that has two sets of edges that cross at an angle, is referred to as a double cut file.

There are nine common file shapes. Each has the same purpose, but with different application.

When using a file, follow these step-by-step procedures:

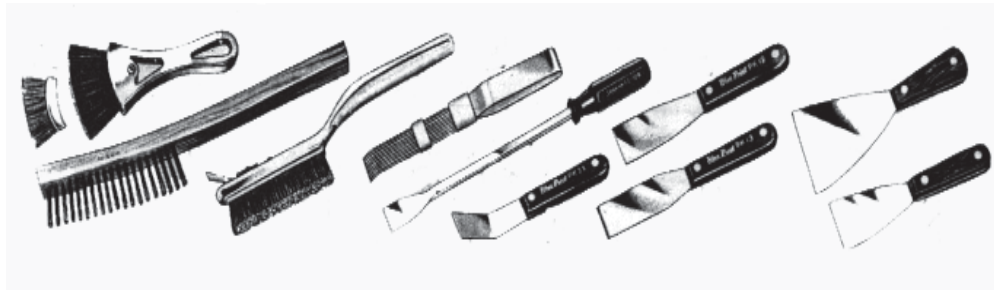
1. Hold the file firmly with both hands.
2. Push the file forward with sufficient pressure to produce 'cut' on the surface of an object.
3. Raise the file slightly on the return stroke to avoid battering the cutting edges.

- Caution:**
1. Choose the right file for the appropriate job.
 2. Rub the file with chalk to prevent it from clogging.
 3. Keep the file clean and free from oil and grease.



11. **Cleaning Tools** - These are different brushes and scrapers which clean parts thoroughly. A special brush for removing carbon may be used manually by using hand operated steel wires. Heavy and fast

work can be operated electrically by attaching power carbon cleaning brushes to the electric drill or grinder.



Sets of Steel Scrapers



Wire Brushes

Caution: Always wear goggles when using power grinders or wire wheels.

12. Multimeter - It is a measuring instrument or tester used to measure AC-DC voltage, electrical current and resistance.

Caution:

- Know what electrical quantity you are going to measure.
- Set the selector switch to the appropriate range.
- Multimeter is a precision instrument. Do not use it as a toy.

B. Basic Automotive Equipment

Automotive equipment in every automotive shop should be given attention. Without these equipment, jobs to be done will take time and consume more physical and mental effort. The following automotive equipment, usually common and available, will be considered.

1. Hydraulic Jack - It used to lift automotive vehicles when working under chassis. Hydraulic jacks are available in either portable jack for light duty application, and an alligator jack for heavy duty application.
2. Battery Charger - This is an electrical device used to return the electrical energy of the battery. Battery chargers are available in 12v, 24v, or 36v charging voltage capacity and charging rate is in ampere-hour.
3. Air-compressor - It is an electrically driven motor with an attached air tank for storing compressed air. It is usually used in tire vulcanizing, spray painting and engines cleaning. It can be portable or hand-carried and a heavy duty one.

4. Chair Hoist – This is composed of a heavy-duty pulley and series of chains. Usually placed in beams or fabricated iron bars. The primary purpose of the chain hoist is to assist in lifting engines for major repair and overhauling.

Words of Wisdom

“If at the end of this lesson, you can say before God that something good has taken place in yourself, then you can say that you have learned!”

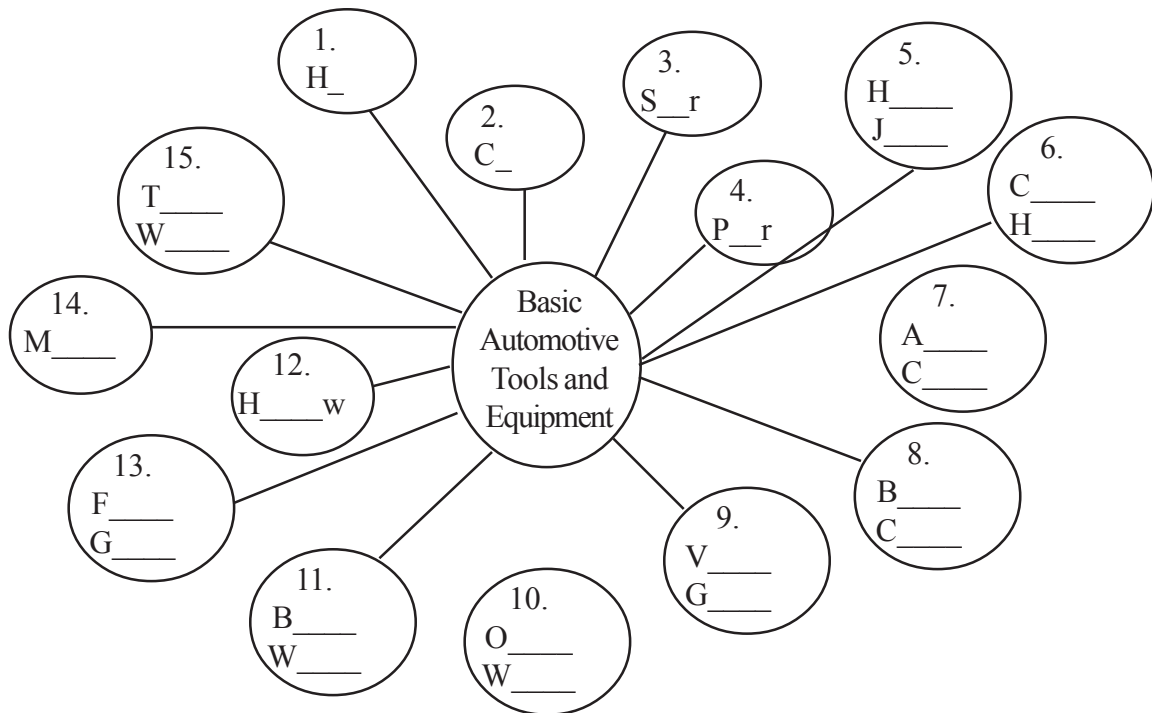
Activity 2

Report to your teacher. Under his close supervision, do the following hands-on activities.

- a. Basic Tools in Automotive - Demonstrate the proper steps in using a hacksaw.
- b. Basic Equipment in Automotive - Show the proper procedures in lifting a vehicle with the use of an alligator jack.

Self-check:

Directions: Fill in the spaces provided on the web by writing the basic tools and equipment in automotive.



For the correct answers, turn to the key to correction at the end of this module. Review the items not correctly answered and find out what your problem is.

Lesson 3

Fundamental Aspects of Automotive (Basic Components of a Vehicle)

Automobiles have constantly increased in variety from time to time, depending on their usage, but the basic components remain the same. You should remember that even though how much it improves the same purpose and function of each component can not be ignored.

Your interest to learn the two basic components of a vehicle is very essential. It stimulates your mind and formulates sound judgement of how these parts have come together to form one unit – a vehicle.

For more understanding, these two components are roughly divided into two – body and chassis.

A. Body - The body is the covering of the whole unit of a vehicle. It carries the driver and passengers or cargo. The vehicle body is usually made of steel sheets 0.6 mm to 3 mm thick and welded into a box shape. It is designed in different shapes and sizes. With various attachments such as the bumper, side mirror, lights, wipers and knobs. The vehicle body has many parts, these are:

1. Windshield glass – It protects the driver and the passengers from dust, rain and outside air pressure.
2. Side panel – It covers the wheels and protects the part and rear body from dust during sunny days, and mud, during the rainy season.
3. Side mirror – It helps the driver when making turn and when overtaking.
4. Hood – Acts as the covering of the engine and other parts.
5. Deck lid – It serves as a covering of the rear baggage compartment. It is also used for storage of spare tires.
6. Bumpers – Front and rear bumpers are used to protect the body from bumps.
7. Doors – Front and rear doors are used for entrance and exit as well as to protect the driver and the passengers from side thrust bumps.
8. Knobs – These serve as handles and lock for opening and closing of the vehicle doors.
9. Top panel – It protects the driver and the passenger from direct heat and rain.
10. Door and body trusses - These protect the passengers, doors and overall body parts from distortion and sudden thrust.

B. Chassis – This is a part of the overall automobile except the body. It comprises different components such as the engine, power trains and other running gears. The components are as follows:

1. Frame - Provides a rigid structural foundation for the car and body and gives a solid attachment for power trains.
2. Engine - This is the power plant component that produces necessary power to run the automobile
3. Power Trains - This refers to a mechanism that transmits power from the engine to the driving wheel.
 - a. Clutch - It is a device used to connect and disconnect the flow of power from the engine to transmission.
 - b. Transmission – This refers to a mechanism that transmits power from the engine via the clutch to the propeller shaft and driving wheels.
 - c. Propeller shaft – It transmits power from the transmission to the differential.
 - d. Differential – It transmits the flow of power from the transmission via the propeller shaft to the driving wheels.
4. Wheels and Tires - These serve to drive the automobile while supporting it as well.
5. Steering System - It allows the change of direction of the vehicle.
6. Suspension System - This provides smoother riding by cushioning the road shocks and vibration.
7. Brake System - It allows the vehicle to slow down or stop.

Activity 3

Report to your teacher. You will be given instruction regarding your nearest automotive shop and observe, record and report to him the following information:

1. Automobile body
Was there any manifestation of work in:

Body washing	cause: _____
Body painting	cause: _____
Body repair	cause: _____
Others: _____	cause: _____

2. Power trains
Was there any manifestation of work in the following:

Engine	Work done: _____
Brakes	Work done: _____
Vulcanizing	Work done: _____
Others: _____	Work done: _____

Self-check:

Directions: Choose the best answer by encircling the letter of your choice.

1. Why is there a need for bumpers in a body?
 - a. Protection from sudden thrust
 - b. Protection from rain
 - c. Protection from the sun
 - d. None of the above

2. How do you protect the driver and passengers from outside pressure of the vehicle?
 - a. Place a bumper
 - b. Place a side mirror
 - c. Place a windshield glass
 - d. None of the above

3. What is the possible reason why side trusses are placed in the auto body?
 - a. Protection from outside pressure
 - b. Protection from distortion and sudden thrust
 - c. Protection from inside pressure
 - d. Protection from heat

4. Door knobs are placed on the side panel to serve as
 - a. Handle and bundle
 - b. Handle and lap
 - c. Handle and switch
 - d. Handle and lock

5. To protect passenger from direct heat and rain, the automobile body is provided with
 - a. Door knobs
 - b. Top panel
 - c. Deck lid
 - d. Hood

6. It is a major part of the vehicle component where all parts are attached, except the body.
 - a. Engine
 - b. Power trains
 - c. Chassis
 - d. Drive wheels

7. Why is a clutch needed in power trains?
 - a. To connect and disconnect flow of power
 - b. To disconnect only the power flow
 - c. To continue power flow
 - d. To connect only the power flow

8. If the brake is designed in a vehicle, then what is its purpose?
 - a. To slow down only the vehicle
 - b. To stop only the vehicle
 - c. To slow down and stop the vehicle
 - d. To slow down and lock the vehicle

9. Besides absorbing road shocks and vibration that a suspension system can give, what is the other advantage?
 - a. Smooth and riding absorption
 - b. Smooth and riding direction
 - c. Smooth and riding pressure
 - d. Smooth and riding comfort

10. A power flow is transmitted from engine via the clutch to the propeller shaft. This mechanism is called:
 - a. Differential
 - b. Power trains
 - c. Transmission
 - d. Steering system

LET'S SUMMARIZE

- Safety first is the best antidote for accidents.
- Tools and equipment are essential in performing a quality job.
- The major parts of vehicle components are the body and chassis.

POSTTEST

In this section, you will be given a test which will help you find out if you have understood what you have read or done. You will have to choose the best answer from the several possible answers given and write its letter on your test paper.

Test I

Directions: Choose only the letter of the correct answer.

1. Exhaust gases contain harmful fumes that are:
 - a. cardinal
 - b. eternal
 - c. fatal
 - d. vital

2. When spillage of oil, grease and other oil containing solvents happens, wipe it:
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 - b. immediately

- c. tomorrow
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3. When operating electronic, hand-driven, or electric operated machines, always consult your:
- a. classmate
 - b. friend
 - c. manual
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4. Placing sharp objects in your pocket while working should:
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 - b. never be done
 - c. sometimes be done
 - d. be totally done
5. Placing jack-stands or supports under the solid parts of a vehicle when jacking-up ensures:
- a. ability
 - b. capability
 - c. nobility
 - d. stability
6. A feeler gauge is placed between:
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7. In using a hacksaw, apply enough _____ to ensure cutting.
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 - b. backward pressure
 - c. toward pressure
 - d. upward pressure
8. To measure the tightness of a bolt or nut, use:
- a. torque wrench
 - b. pipe wrench
 - c. adjustable wrench
 - d. open wrench
9. Which of the tools is best in loosening and tightening bolts and nuts?
- a. open-end wrench
 - b. box-end wrench
 - c. socket wrench
 - d. pipe wrench

10. It is a special type of screwdriver used in difficult areas:
- a. phillips
 - b. flat-tip
 - c. clutch tip
 - d. offset

Test II.

Directions: Identify the following pictures. Write only the letter of the correct answer.

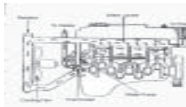
1. radiator

a.



2. hacksaw

b.



3. chisel

c.



4. connecting rod

d.



5. wrench

e.



For the correct answers turn to the key to correction at the end of this module. Review the items not correctly answered and find out what your problem is. Find out to which bracket in the scorecard you belong after correcting your own paper.

Suggested Activities:

1. Read the following supplementary reading materials.
 - a. Gas Engine Manual by Audels
 - b. Automotive Mechanics by William H. Crouse
 - c. Automotive Fundamentals by Ray F. Kuns
2. Visit nearby automotive repair shops and observe the following:
 - a. Body repair

- b. Power train services
- c. Tools and equipment used in automotive

KEY TO CORRECTION

Pretest / Posttest

Test I

- 1. c
- 2. b
- 3. d
- 4. b
- 5. d
- 6. c
- 7. c
- 8. a
- 9. c
- 10. d

Test II

- 1. b
- 2. e
- 3. a
- 4. c
- 5. d

Self-check

Lesson 1

Safety Shop Work Practices

- 1. fatal
- 2. never be done
- 3. immediately
- 4. stability
- 5. teacher

Lesson 2

Tools and Equipment

- 1. hammer
- 2. chisel
- 3. screwdriver
- 4. plier
- 5. hydraulic jack
- 6. chain hoist

7. air-compressor
8. battery charger
9. vise-grip
10. open-wrench
11. box wrench
12. hacksaw
13. feeler gauge
14. multimeter
15. torque wrench

Lesson 3

Vehicle Components

1. a
2. c
3. b
4. d
5. b
6. c
7. a
8. c
9. d
10. c

Scorecard

Find out to which bracket you belong after correcting your own paper.

Score	Equivalent
17-20	Excellent
13-16	Very Good
9-12	Good
5-8	Needs improvement
0-4	Poor

If your score is 7 and above, congratulations. If you did not do well, review the questions you missed. Better luck next time.