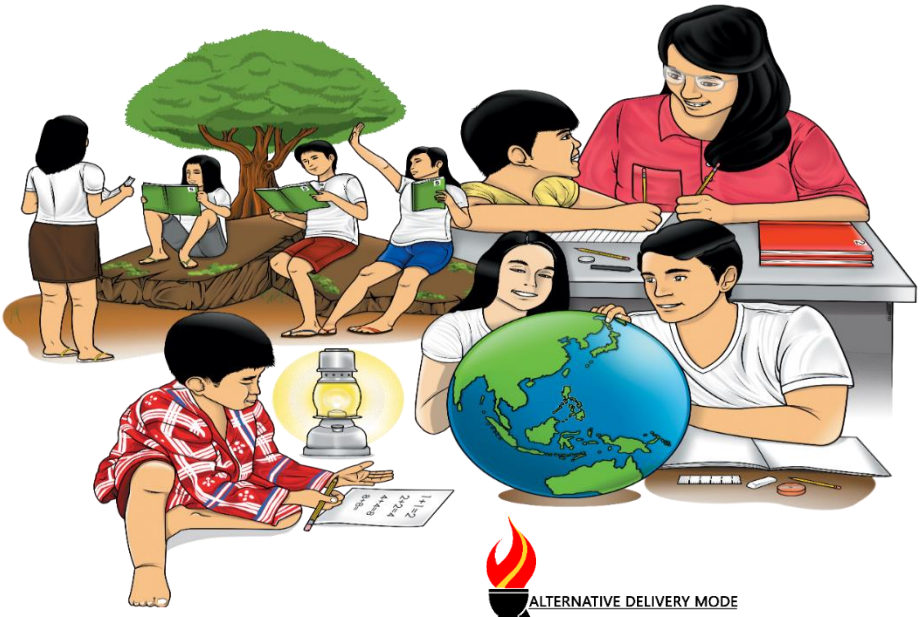
10

# Special Program in Technical Vocational Education

## Quarter 1 - Module 2
## Servicing Automotive Battery
(Testing of an automotive battery)

### Automotive Servicing NC II



ALTERNATIVE DELIVERY MODE

# 10

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## Quarter 1 - Module 2
## Servicing Automotive Battery
(Testing of an automotive battery)

**Automotive Servicing NC II**

DepED
DEPARTMENT OF EDUCATION

**IA-Automotive Servicing – Grade 10**
**Alternative Delivery Mode**
**Quarter 1 – Module 2: Servicing Automotive Battery**
**(Demonstrate the Testing of an Automotive Battery)**



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**Development Team of the Module**

**Writer:** Aldrin T. Bongsian & Pablo B. Mariacos
**Editors:**
**Reviewer:** Jonalyn C. Ambrona
Mary Jane N. Malihod
**Illustrator:**
**Layout Artist:**
**Management Team:** Estela Leon-Cariño
Carmel F. Meris
Rosita C. Agnasi
Federico P. Martin
Christopher C. Benigno
Juliet C. Sannad
Mary Jane N. Malihod
Armi Victoria Fiangaan
Brenda M. Cariño

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Office Address: Wangal, La Trinidad, Benguet
Telefax: (074) -422 -4074
E-mail Address: car@deped.gov.ph

# Introductory Message

This Self-Learning Module (SLM) is prepared so that you, our dear learners, can continue your studies and learn while at home. Activities, questions, directions, exercises, and discussions are carefully stated for you to understand each lesson.

Each SLMS is composed of different parts. Each part shall guide you step-by-step as you discover and understand the lesson prepared for you.

Pre-tests are provided to measure your prior knowledge on lessons in each SLM. This will tell you if you need to proceed on completing this module or if you need to ask your facilitator or your teacher's assistance for better understanding of the lesson. At the end of each module, you need to answer the post-test to self-check your learning. Answer keys are provided for each activity and test. We trust that you will be honest in using these.

In addition to the material in the main text, Notes to the Teacher are also provided to our facilitators and parents for strategies and reminders on how they can best help you on your home-based learning.

Please use this module with care. Do not put unnecessary marks on any part of this SLM. Use a separate sheet of paper in answering the exercises and test. And read the instructions carefully before performing each task.

If you have questions in using this SLM or any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator.

Thank you.

***Notes to the Teacher***

This contains helpful tips or strategies that will help you in guiding the learner.

For the facilitator:

Hi, as a facilitator you are expected to orient the learners on how to use this module. You also need to keep track of the learners' progress while allowing them to manage their own learning. Kindly, advise the learner's parents or guardians of the same procedure since they will be the primary supporters in the learners' progress. Please, do not forget to remind the learner to use separate sheets in answering all of the activities found in the learning module.

For the learner:

Hello learner, Welcome to the Automotive Servicing NC II Alternative Delivery Mode (ADM) Module on Servicing Automotive Battery (Testing of an Automotive Battery). I hope you are ready to progress in your Grade 10 SPTVE in Automotive with this learning module. This is designed to provide you with interactive tasks to further develop the desired learning competencies prescribed in our curriculum. With this, you are expected to appreciate staking through the information and activity given.

This module has the following parts and corresponding icons:

| ICON | LABEL | DETAIL |
|---|---|---|
|  | What I Need to Know | This contains the learning objectives which you need to accomplish. |
|  | What I know | This evaluates what you know about the lesson you are to learn. |
|  | What's In | This connects the current lesson with a topic necessary in your understanding. |
|  | What's New | This introduces the lesson through an activity. |
|  | What Is It | This contains a brief discussion of the learning module lesson. |
|  | What's More | These are activities to check your understanding of the lesson. |
|  | What I Have Learned | This summarizes the important ideas presented in the lesson. |
|  | What I Can Do | This is a real-life application of what you have learned. |
|  | Assessment | This is a post assessment of what you have learned. |
|  | Additional Activity | This is an activity that will strengthen your knowledge about the lesson. |

At the end of this module you will also find:

References — This is a list of all sources used in developing this module.

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# LESSON 2

# Testing of an Automotive Battery

The following are some reminders in using this module:

1. Use the module with care. Do not put unnecessary mark/s on any part of the module. Use a separate sheet of paper in answering the exercises.
2. Don't forget to answer *What I Know* before moving on to the other activities included in the module.
3. Read the instruction carefully before doing each task.
4. Observe honesty and integrity in doing the tasks and checking your answers.
5. Finish the task at hand before proceeding to the next.
6. Return this module to your teacher/facilitator once you are through with it.

If you encounter any difficulty in answering the tasks in this module, do not hesitate to consult your teacher or facilitator. Always bear in mind that you are not alone.

We hope that through this material, you will experience meaningful learning and gain deep understanding of the relevant competencies. You can do it!

## *What I Need to Know*

This module was designed and written to guide you to acquire the learning competencies and develop your skills in Testing an Automotive Battery in IA- Automotive Servicing. The scope of this module permits it to be used in many different learning situations. The language used recognizes the diverse vocabulary level of students. The lessons are arranged to follow the standard sequence of the course. However, the order in which you read the module can be changed to correspond with the textbook you are now using.

| | |
|---|---|
| Quarter/Week | Q1/W2 |
| Learning Competency Code | SPTVE_IAAUS9-12SAB-Ic-d-2 |
| Learning Competency | **LO 2. Demonstrate the Testing of an Automotive Battery** |

**Learning Objectives:**

After going through this module, you are expected to:

1. select appropriate test equipment;
2. test different types of batteries;
3. analyze test results; and,
4. develop traits such as adaptability, creativity, independence and passion towards learning.

# *What I Know*

**Pre-Test**
**Multiple choice**

**Direction:** Choose the LETTER of the best answer and write in the answer sheet.

1. When performing a capacity test on a battery, the electrolyte should be as close to?
   a. 86 °F b. 80 °F c. 100 °F d. 120°F
2. It is the weight of a given volume of any liquid divided by the weight of an equal volume of water.
   a. battery solution b. coolant c. specific gravity d. specific gravity test
3. The specific gravity of an unsealed battery is measured using what tool/equipment?
   a. hydrometer b. multi-tester c. voltmeter d. all of the above
4. A battery is considered good when its specific gravity is in between?
   a. 1.260-1.280 b. 1.280-1.285 c. 1.285-1.290 d. 1.290-1.295
5. A test that can be used as a substitute for the hydrometer specific test?
   a. capacity test b. drain test c. leakage test d. open circuit voltage test
6. A test that determines how well a battery functions under a load?
   a. capacity test b. drain test c. leakage test d. open circuit voltage test
7. Also called as conductance test?
   a. capacity test b. capacitance test c. drain test d. leakage test
8. A test that is used on a battery is dead after it has not been used for a short while and this kind of test varies according to the manufacturer?
   a. capacity test b. capacitance test c. drain test d. leakage test
9. A test that is used to determine if current is discharging across the top of a battery?
   a. capacity test b. capacitance test c. drain test d. leakage test
10. A maintenance free battery has an open circuit voltage of 12.6 volts. Which of the following should be done?
   a. Recharge and retest the battery c. Replace the battery
   b. Reinstall the battery, battery is sufficient d. None of the above
11. The allowable battery's temperature in conducting an open circuit voltage test is?
   a. 60-100 °F b.65-100 °F c. 70-100 °F d. 75-100 °F
12. Never conduct capacity or load test in a battery if its temperature is below?
   a. 50°F b. 60°F c. 70°F d. 80°F
13. In a maintenance free battery with a built-in hydrometer, green that is very visible means battery is?
   a. charge before testing c. Good
   b. replace battery d. none of the above
14. In a maintenance free battery with a built-in hydrometer, dark green that is not visible means battery is?
   a. charge before testing c. Good

b. replace battery d. none of the above

15. In a maintenance free battery with a built-in hydrometer, light or yellow means battery is?

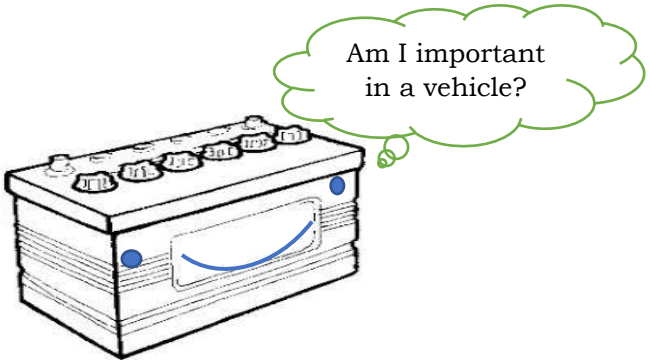
a. charge before testing c. Good

b. replace battery d. none of the above

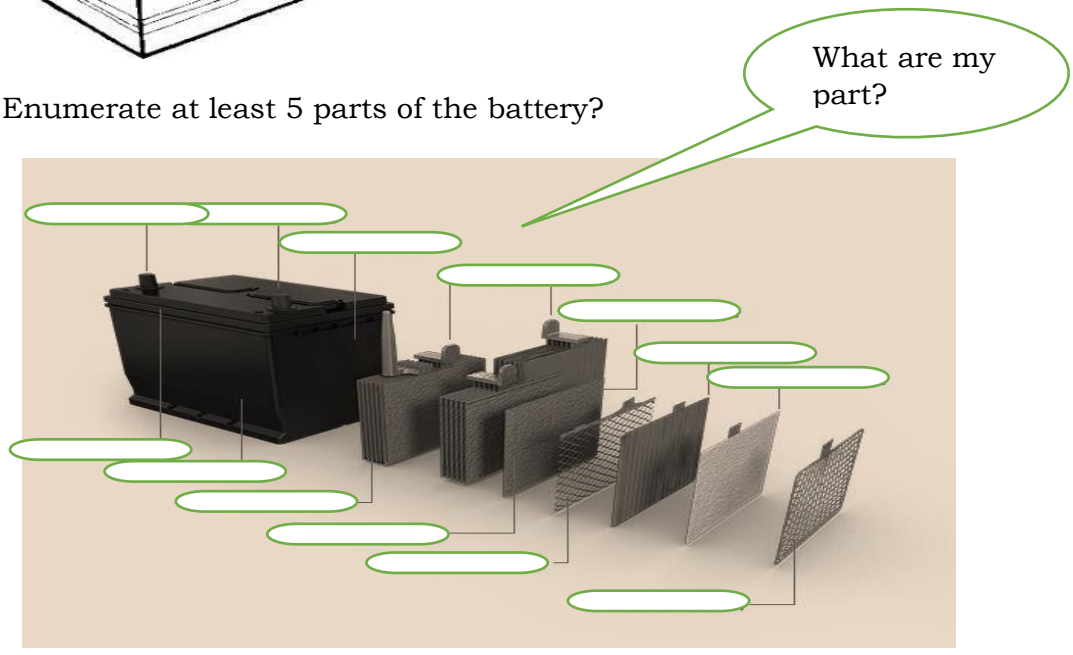
## *What's In*

Read each question carefully then write your answers in the answer sheet.

a. What is the purpose of the automotive battery?




b. Enumerate at least 5 parts of the battery?



## *What's New*

**Word Search**

**Direction:** The following words are the several ways in testing a battery. Look for the 6 words in the given word search puzzle. Write your answer in the answer sheet.

| S | D | S | E | D | T | D | S | A | F | E | T | Y | A | R | D | K | W |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O | P | E | N | C | I | R | C | U | I | T | V | O | L | T | A | G | E |
| S | L | E | A | L | E | A | K | A | G | E | G | Q | E | C | F | H | S |
| A | J | Y | C | A | S | W | W | H | T | R | U | A | R | C | G | G | T |
| S | K | R | T | I | K | E | E | I | Y | E | J | S | Y | A | T | O | E |
| C | P | F | O | R | F | R | T | O | U | W | H | D | U | P | A | I | D |
| D | O | T | I | E | H | I | R | P | I | A | F | S | I | A | S | U | I |
| G | R | G | U | T | U | T | C | J | O | S | L | P | F | C | K | Y | S |
| H | U | A | J | A | Y | Y | K | G | G | O | D | O | D | I | R | T | P |
| R | Y | N | I | M | T | U | J | G | R | S | E | I | S | T | T | D | O |
| T | T | H | F | N | H | I | H | T | F | A | R | U | E | Y | T | E | S |
| Y | R | U | S | D | T | O | G | R | T | E | V | Y | A | T | Y | S | A |
| F | E | I | E | F | F | E | D | F | G | F | F | I | W | R | U | W | L |
| E | Q | U | I | P | M | E | S | T | S | U | T | Y | T | E | I | E | W |
| E | E | O | R | R | F | Q | S | T | Y | Y | Y | T | R | Y | G | R | D |
| V | I | S | U | A | L | I | N | S | P | E | C | T | I | O | N | D | S |

## *What Is It*

### BATTERY TESTING

Previously, you have learned that battery plays an important rule on a vehicle that is why knowing how to test your car's battery is also very important.

### Battery Testing and Interpreting Results

Testing batteries is an important part of electrical system service. Depending on the design of the battery, state of charge and capacity can be determined in several ways; specific gravity tests, visual inspection of batteries with a built-in hydrometer, open circuit voltage tests, capacity test, battery leakage test and battery drain test.

### Ways in Testing a Battery

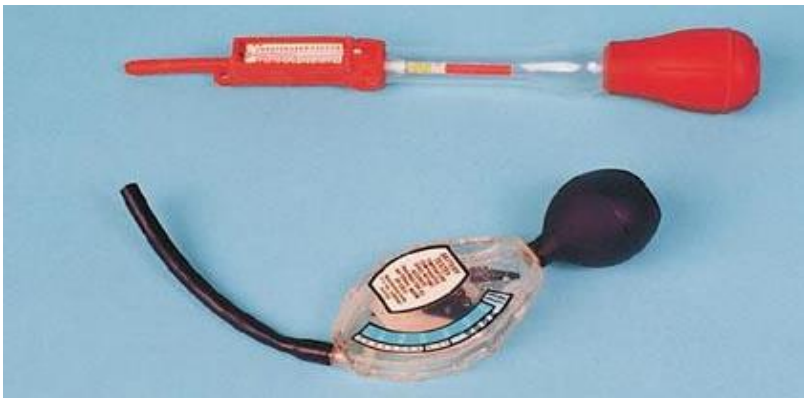
**1.*Specific Gravity Tests***

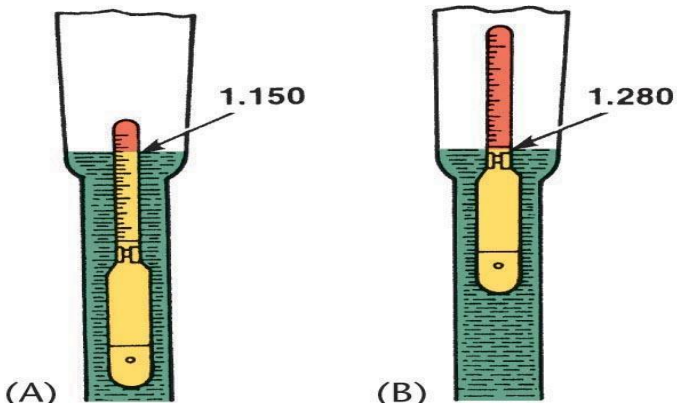
Specific gravity is the weight of a given volume of any liquid divided by the weight of an equal volume of water. Pure water has a specific gravity of 1.000, while battery electrolyte should have a specific gravity of 1.260 to 1.280 at 80$^{O}$F (26.7$^{O}$C). In other words, the electrolyte should be 1.260 to 1.280 times heavier than water.

On unsealed batteries, the specific gravity of the electrolyte can be measured to give a fairly good indication of the battery's state of charge using a hydrometer. A **hydrometer** consists of a glass tube or barrel, rubber bulb, rubber tube, and a glass float or hydrometer with a scale built into its upper stem. The glass encases the float and forms a reservoir for the test electrolyte. Squeezing the bulb pulls electrolyte into the reservoir. The picture below shows the two types of hydrometers.

Two types of battery hydrometers.

When filled with test electrolyte, the sealed hydrometer float bobs in the electrolyte. The depth to which the glass float sinks in the test electrolyte indicates its relative weight compared to water. The reading is taken off the scale by sighting along the level of the electrolyte.






(A) When the scales sink in the electrolyte, the specific gravity is low.

(B) When it floats high, the specific gravity is high.

The specific gravity of the electrolyte decreases as the battery discharges. This is why measuring the specific gravity of the electrolyte with a hydrometer can be a good indicator of how much charge a battery has lost. Table below is lists specific gravity readings in various stages of charge with respect to a battery's ability to crank an engine at a temperature of 80°F (26.7°C).

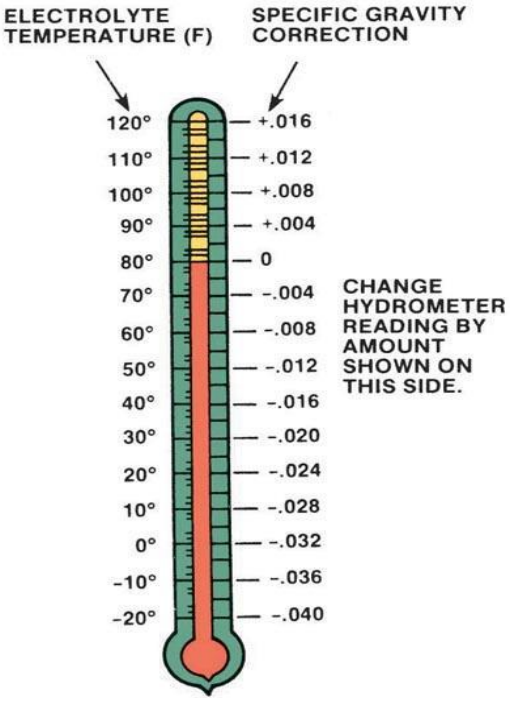
| ELECTROLYTE SPECIFIC GRAVITY AS RELATED TO CHARGE | |
|---|---|
| **Specific Gravity** | **Percent of Charge** |
| 1.265 | 100% |
| 1.225 | 75% |

***CAUTION!***

*Electrolyte is very corrosive. It can cause severe injuries if it comes in contact with your skin or eye. If electrolyte gets on you, immediately wash with baking soda and water. If the acid gets in your eyes, immediately flush with cool water. Then get medical help.*

| | |
|---|---|
| 1.190 | 50% |
| 1.155 | 25% |
| 1.120 or lower | discharged |

**Temperature Correction** It is necessary to correct the reading by adding or subtracting 4 points (0.004) for each 10°F (-12°C) above or below the standard of 80°F (26.7°C). Most hydrometers have a built-in thermometer to measure the temperature of the electrolyte. The hydrometer reading can be misleading if the hydrometer is not adjusted properly. For example, a reading of 1.260 taken at 20°F (-6.6°C) would be 1.260 – (6× 0.004 or 0.024) = 1.236. This lower reading means the cell has less charge than indicated.




Hydrometer with thermometer correction scales make adjusting for electrolyte temperature easy.

It is important to make these adjustments at high and low temperatures to determine the battery's true state of charge

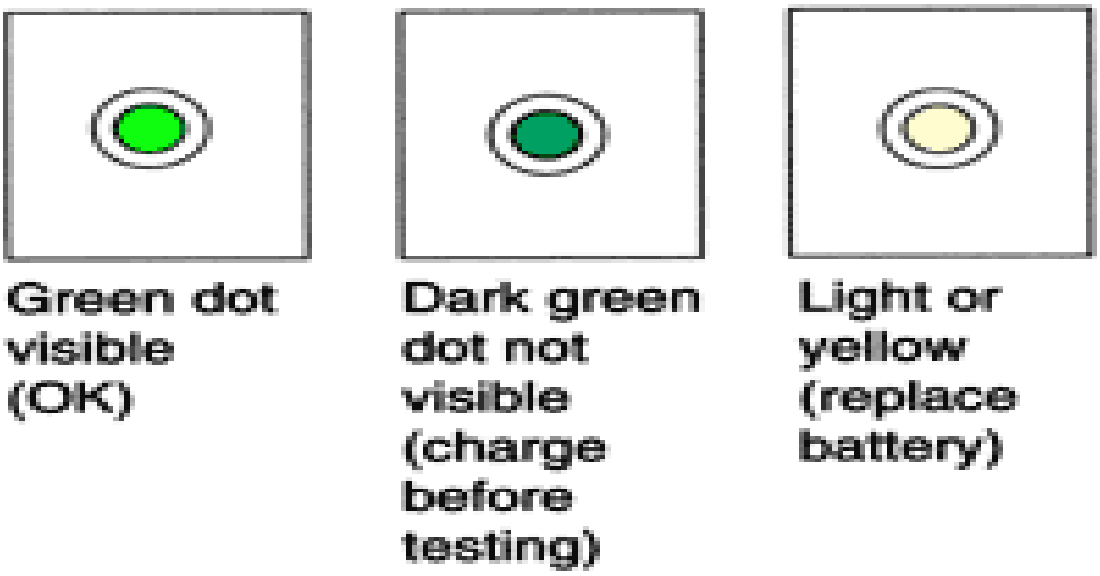
**Interpreting Results,** the specific gravity of the cells of a fully charged battery should near 1.265 when adjusted for electrolyte temperature.

Recharge any battery if the specific gravity drops below an average of 1.230. A specific gravity difference of more than 50 points between cells is a good indication of a defective battery in need of replacement.

### 2. *Visual Inspection of Batteries with A Built-In Hydrometer*

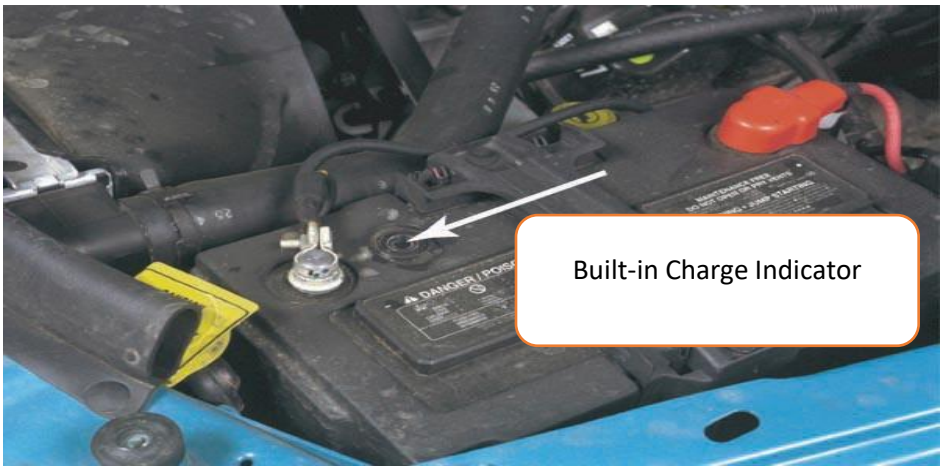
On some sealed maintenance-free batteries, a special temperature-compensated hydrometer is built into the battery cover. A quick visual check indicates the battery state of charge. It is important when observing the built-in hydrometer that the battery has a clean top to see the correct indication. A flashlight may be required in poorly lit areas. Always look straight down when viewing the built-in hydrometer.

Example illustration of a maintenance free battery with built-in hydrometer.




Built-in hydrometers on maintenance-free sealed batteries interpretations.

A few battery designs incorporated a charge indicator into the top of the battery. Rather than a built-in hydrometer, these batteries use a color display to note the battery's state of charge. The color green stands for "OK" gray for "check or recharge," and white for "change or replace."




Many maintenance-free batteries do not have a built-in hydrometer. A voltage check is the only way to check this type of battery's state of charge. The specific gravity of these batteries cannot be checked because they are sealed. *Never* pry off the cell caps to check the electrolyte levels of condition of a sealed battery.

### 3. *Open circuit voltage tests*

An open circuit voltage check can be used as a substitute for the hydrometer specific test. As the battery is charged or discharged, slight changes occur in the battery's voltage. So battery voltage with no load applied can give some indication of the state of charge.


Measuring open circuit voltage across battery terminals using a voltmeter.

Procedures in conducting open circuit voltage test;

1. Make sure that the battery's temperature should be between 60$^{O}$ and 100$^{O}$F (15.5$^{O}$ and 37.7$^{O}$C). The voltage must be allowed to stabilize for at least 10 minutes with no load applied.
2. On vehicles with high drains (computer controls, clocks, and accessories that always draw a small amount of current), it may be necessary to disconnect the battery ground cable.
3. On batteries that have just been recharged, apply a heavy load for 15 seconds to remove the surface charge. Then allow the battery to stabilize.
4. Once voltage has stabilized, use a voltmeter to measure the battery voltage to the nearest one-tenth of a volt.
5. Use Table below to interpret the results. As you can see, minor changes in battery open circuit voltage can indicate major changes in state of charge.

**TABLE OF BATTERY OPEN CIRCUIT VOLTAGE AS AN INDICATOR OF STATE OF CHARGE**

| Open Circuit Voltage | State of Charge |
|---|---|
| 12.6 or greater | 100% |
| 12.4 to 12.6 | 75-100% |
| 12.2 to 12.4 | 50-75% |
| 12.0 to 12.2 | 25-50% |

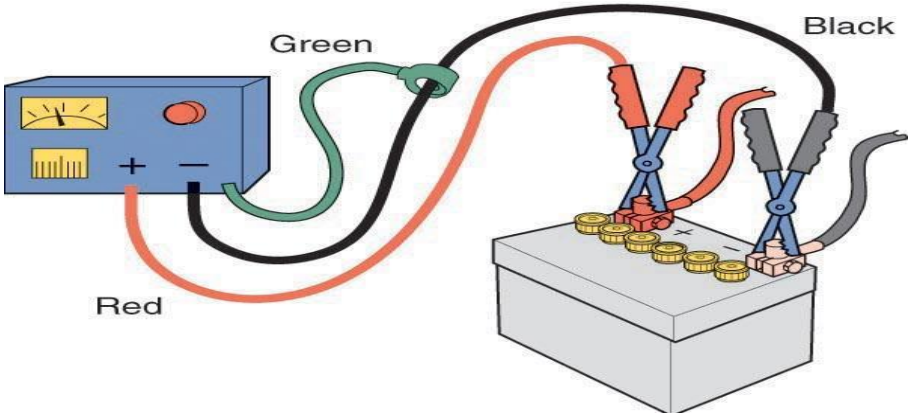
| | |
|---|---|
| 11.7 to 12.0 | 0-25% |
| 11.7 or less | 0% |

If the open circuit voltage test indicates a charges of below 75% of full charge, recharge the battery and perform the capacity test to determine battery condition.

### 4. *Capacity Test*

The load or capacity test determines how well any type of battery, sealed or unsealed, functions under a load. In other words, it determines the battery's ability to furnish starting current and still maintain sufficient voltage to operate the ignition system.

The load or capacity test can be performed with the battery either in or out of the vehicle. The battery must be at or very near a full state of charge. For best results, the electrolyte should be as close to 80°F (26.7°C) as possible. Cold batteries show considerably lower capacity.




Typical tester hook-up for conducting a battery load test.

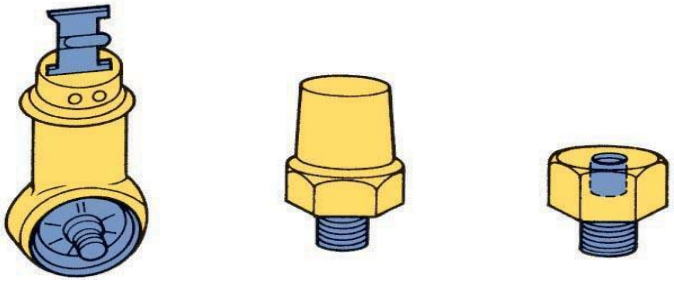
A battery tester with a carbon pile should be used to check the capacity of a battery.

**NOTE**: Never load test a sealed battery if its temperature is below 60°F (15.5°C).

On batteries with side terminals, obtaining a sound connection can be problem. The best solution is to screw in the appropriate manufacturer's adapter.

If an adapter is not available, use a 3/8 inch (9.54mm) coarse bolt with a nut on it. Bottom out the bolt. Back it off a turn. Then lighten the nut against the contact. Now, attach the lead to the nut.

Adapters may be needed to test and charge batteries with side-mount terminals.



**Battery load test procedures or guidelines:**

1. The inductive pickup must surround the negative cable of the tester.
2. Observe the correct polarity and make sure the test leads are making good contact with the battery posts.
3. Turn the load control knob (if the tester is so equipped) to draw current at the rate of three times the battery's ampere-hour rating or one-half of its CCA rating
4. Maintain the load for 15 seconds. Observe the tester's voltmeter
5. Discontinue the load for after 15 seconds of current draw.
6. At 70$^{O}$F (21$^{O}$C) or above or on testers that are temperature compensated, voltage at the end of 15 seconds should not fall below 9.6 volts. If the tester is not temperature compensated, use table below to determine the adjusted minimum voltage reading for a particular temperature.

**Interpreting Results**

If the voltage reading exceeds the specification by a volt or more, the battery is supplying sufficient current with a good margin of safety. If the reading is right on the spec, the battery might not have the reserve necessary to handle cranking during low temperatures. If the battery was at 75% charge and fell right on the load specifications, it is probably being in a good shape.

| MINIMUM LOAD TEST VOLTAGES AS AFFECTED BY TEMPERATURE | |
|---|---|
| Battery Temperature (F) | Minimum Test Voltage |
| 70$^{O}$ (21$^{O}$C) | 9.6 volts |
| 60$^{O}$ (15.5$^{O}$C) | 9.5 volts |

| | |
|---|---|
| 50° (10°C) | 9.4 volts |
| 40° (4.4°C) | 9.3 volts |
| 30° (-1°C) | 9.2 volts |
| 20° (-6.6°C) | 8.9 volts |
| 10° (-12.2°C) | 8.8 volts |
| 0° (-17.7°C) | 8.5 volts |

If the voltage read below the temperature-corrected minimum, continue to observe the voltmeter of the tester after removing the load. If it rises above 12.4 volts, the battery is bad. It can hold a charge but has insufficient cold-cranking amperes. The battery can be recharges and retested, but the results are likely to be the same.

If the voltage test below the minimum and the voltmeter does not rise above 12.4 volts when the load is removed, the problem may only be a low state of charge. Recharge the battery and **lead test** again.

If a volt-ampere tester is not available, the starter motor can be used as a loading device to conduct a capacity test. By observing a voltage reading before and after the starting motor has run, the condition of the battery can be determined. Connect the voltmeter across the battery. Make sure ignition is disabled to prevent engine starting.

**5. *Capacitance Test***

A conductance (capacitance) battery tester.

Also called as **conductance test**. Conductance describes a battery's ability to conduct current. It is a measurement of the plate surface available in a battery for chemical reaction.

Measuring conductance provides a reliable indication of a battery's condition and is correlated to the battery capacity. Conductance can be used to detect cell defects, shorts, normal aging, and open, circuits, which can cause the battery to fail.

A fully charged new battery will have a high conductance reading, anywhere from 110% to 140% of its CCA rating. As a battery ages, the plate surface can sulfate or shed active material, which will lower its capacity and conductance.

When a battery has lost a significant percentage of its cranking ability, the conductance reading will fall well below its rating and the test decision will be to replace the battery. Because conductance measurements can track the life of the battery, they are also effective for predicting end of the life before the battery fails.

How Conductance Tester operates?

The tester creates a small signal that is sent through the battery and then measure a portion of the AC current response. The tester displays the service condition of the battery. The tester indicates that the battery is good, needs to be recharged and tested again, has failed, or will fail shortly.

**6.*Leakage Test***

A battery leakage test will **determine if current is discharging across the top of the battery**. A dirty battery can discharge when not in use. This condition shortens battery life and causes starting problems. To perform a battery leakage test, set a voltmeter on a low setting.

**Procedures/Guidelines in Conducting Battery Leakage Test**

a. Set a voltmeter on a low DC volt range.
b. Connect the negative test lead to the battery negative terminal.
c. Then move the meter's positive lead across the top and sides of the battery case.

**Interpretation:**

If some voltage is read on the voltmeter, current is leaking out of battery cells. The battery should be cleaned, then rechecked.

If the battery again has some leakage, it should be replaced because the case is excessively porous or is cracked.

### *7.Drain Test*

If a vehicle's battery is dead after it has not been used for a short while, the problem may be a current drain caused by one of the electrical systems. The most common cause for this type of drain is a light that is not turning off—such as a light in the glove box, trunk, or engine compartment.

Constant drains on the battery due to accessories that draw small amounts of current called parasitic drains. These drains on the battery can cause various drivability problems. With low battery voltage several problems can result; the computer may go into the backup mode of operation, the computer may set false codes, or the computer may raise idle speeds to compensate for the low battery voltage.

**Procedures/Guidelines in Conducting Battery Drain Test**

- **a.** Turn off all accessories and close the doors.
- **b.** Remove the under hood lamp, if equipped.
- **c.** Disconnect the negative battery cable.
- **d.** Attach the multiplying coil between the negative battery cable and the battery terminal post**.**
- **e.** Zero the ammeter.
- **f.** Connect the inductive pickup probe around the multiplying coil.
- **g.** Read the ammeter.

The maximum permissible current drain is 0.05 ampere. If the current drain exceeds this limit, remove the fuses, one at a time, as discussed earlier.

**Note:** The procedure for performing a battery drain test varies according to the manufacturer. However, battery drain can often be observed by connecting an ammeter in series with the negative cable or by placing the inductive ammeter lead around the negative cable. If the meter reads 0.25 or more amps, there is excessive drain. Visually check the trunk, glove box, and under hood lights to see if they are on. If they are, remove the bulb and watch the battery drain.

## *What's More*

**Activity 1**

**Directions:** Complete the table below. Write the specific gravity according to the given percentage of charge. Write your answers in the answer sheet.

| Percent of Charge | Specific Gravity |
|---|---|
| 100% | 1. |
| 75% | 2. |
| 50% | 3. |
| 25% | 4. |
| discharged | 5. |

**Activity 2.**

**Direction:** Write **TRUE** if the statement is correct otherwise **FALSE** if it is wrong. Write your answer in the answer sheet.

1. In testing a battery using a hydrometer, when the scales sink in the electrolyte, the specific gravity is high.
2. In testing a battery using a hydrometer, when the scales float high, the specific gravity is low.
3. In a maintenance free battery that has a built-in hydrometer, green color indicates above state of charge.
4. In a maintenance free battery that has a built-in hydrometer, dark color indicates low level of electrolyte.
5. In a maintenance free battery that has a built-in hydrometer, clear or no color indicates below state of charge.
6. In a battery that has a built-in charge indicator, color white stands for "OK".
7. In a battery that has a built-in charge indicator, color gray stands for check or recharge battery.
8. In a battery that has a built-in charge indicator, color green stands for change or replace battery.
9. The specific gravity of the electrolyte decrease as the battery discharge.
10. The specific gravity of the electrolyte increase as the battery is charging.

## *What I Have Learned*

**Directions:** Complete the following letter. Write your answer in the answer sheet.

Let us first reflect on the things we have learned about the several ways in testing a battery by completing the following "My Reflections".

My Reflection

Dear Teacher,

I have learned that _____1_____ is an important part of electrical system service for it will help me determine if my car's battery is nearing the end of its usefulness and whether I need to replace it and is determined in several ways like specific gravity test, ____2____, _____3_____, _____4_____, _____5_____, _____6_____, _____7_____. I have learned also that different _____8_____ instrument is used in the different test and with proper _____9_____ to avoid any disease/health problem that may be caused by battery's harmful chemicals.

Sincerely yours,

_____

## *What I Can Do*

**Direction**: Explain briefly what is being ask in the following questions. Write your answer in the answer sheet.

1. Supposed you have a vehicle at home using a maintenance free battery with built-in charge indicator. Upon opening the hood, you noticed that the indicator is in color white. What does it mean and what will you do?
2. During pandemic, your vehicle was stock in almost 30 days. A friend says, you must frequently start your vehicle to prevent stock-up of parts. Upon checking the engine compartment, you noticed that the battery is dirty and each terminal was corroded. Upon start-up, the engine has no response at all. What would be the problem and what specific test must be done on the battery?

# *Post-Assessment*

**Multiple choice**. Read each question carefully and write the letter that corresponds to the **BEST** answer in the answer sheet.

1. A battery is considered good when its specific gravity is in between?
   a. 1.260-1.280 b. 1.280-1.285 c. 1.285-1.290 d. 1.290-1.295
2. The allowable battery's temperature in conducting an open circuit voltage test is?
   a. 60-100 °F b.65-100 °F c. 70-100 °F d. 75-100 °F
3. Never conduct capacity or load test in a battery if its temperature is below?
   a. 50°F b. 60°F c. 70°F d. 80°F
4. When performing a capacity test on a battery, the electrolyte should be as close to for best results?
   a. 80 °F b. 90°F c. 100 °F d. 120°F
5. It is the weight of a given volume of any liquid divided by the weight of an equal volume of water.
   a. battery solution b. coolant c. specific gravity d. specific gravity test
6. The specific gravity of an unsealed battery is measured using what tool/equipment?
   a. hydrometer b. multi-tester c. voltmeter d. all of the above
7. A test that can be used as a substitute for the hydrometer specific test?
   a. capacity test b. drain test c. leakage test d. open circuit voltage test
8. A test that determines how well a battery functions under a load?
   a. capacity test b. drain test c. leakage test d. open circuit voltage test
9. Also called as conductance test?
   a. capacity test b. capacitance test c. drain test d. leakage test
10. A test that is used on a battery is dead after it has not been used for a short while and this kind of test varies according to the manufacturer?
    a. capacity test b. capacitance test c. drain test d. leakage test
11. A test that is used to determine if current is discharging across the top of a battery?
    a. capacity test b. capacitance test c. drain test d. leakage test
12. In a maintenance free battery with a built-in hydrometer, green that is very visible means?
    a. charge before testing b. replace battery c. Good d. none of the above
13. In a maintenance free battery with a built-in hydrometer, dark green that is not visible means?
    a. charge before testing b. replace battery c. Good d. none of the above

14. In a maintenance free battery with a built-in hydrometer, light or yellow means?
    a. charge before testing b. replace battery c. Good d. none of the above

15. A maintenance free battery has an open circuit voltage of 12.6 volts. Which of the following should be done?
    a. Recharge and retest the battery
    b. Reinstall the battery, battery is sufficient
    c. Replace the battery
    d. None of the above

## *Additional Activity*

***Direction:*** Answer the following in the answer sheet.

a. Enumerate the personal protective equipment that you will use in replacing the battery.

The Personal Protective Equipment are;

1.
2.
3.
4.
5.

# *Answer Key*

**What I Know**

1. B
2. C
3. A
4. A
5. B
6. A
7. B
8. C
9. D
10. B
11. A
12. B
13. C
14. A
15. B

**What's in**

Purpose of automotive battery

Supplies electric energy to an automobile. Usually this refers to an SLI battery (starting, lighting, and ignition) to power the starter motor, the lights, and the ignition system of a vehicle engine. An automotive battery may also be a traction battery used as the main power source of an electric vehicle.

a. Battery Case
b. Battery Post
c. Vent Cap
d. Negative and Positive Plate
e. Connector
f. Separator
g. Post Strap
h. Battery Solution

**What's New**

specific gravity, visual inspection, open circuit voltage, capacity, leakage and drain test.

**What's More**

Activity 1

1. 1.265
2. 1.225
3. 1.190
4. 1.155
5. 1.120 or lower

Assessment 1

1. False
2. False
3. True
4. False
5. False
6. False
7. True
8. False
9. True
10. True

**What I Have Learned**

1. Battery Testing
2. Visual inspection with a built-in hydrometer
3. Open circuit voltage tests
4. Capacity test
5. Battery leakage test
6. Capacitance Test
7. Battery drain test.
8. Measuring/test
9. Personal protective equipment

Answers from 2-7 may interchange

**What I Can Do**

Answers may vary

**Post Assessment**

| | | |
|---|---|---|
| 1. a | 6. a | 11. d |
| 2. a | 7. d | 12. c |
| 3. b | 8. a | 13. b |
| 4. a | 9. b | 14. b |
| 5. c | 10. c | 15. b |

**Additional Activity**

1. Safety goggles
2. Apron
3. Safety shoes
4. safety gloves
5. proper attire

# References

Auto Mechanics 10th Edition by Crouse/Anglin, Glencoe Division of Macmillian/McGraw-Hill School Publishing Company, USA 1993

Auto Mechanics Theory and Service by deKryger et.al, South-Western Publishing Co.USA 1986

Automotive Electricity, Electronics and Computer Controls By: Barry Hollembeak, Delmar Cengage Learning, USA 1998

Automotive 3&4. Module 5 SEDP Series. By Dante Sanopo. Basic Media System, INC. 1993, Makati, M.M.

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**For inquiries or feedback, please write or call:**

Department of Education - Bureau of Learning Resources (DepEd-BLR)
Ground Floor, Bonifacio Bldg., DepEd Complex
Meralco Avenue, Pasig City, Philippines 1600
Telefax: (632) 8634-1072; 8634-1054; 8631-4985
Email Address: blr.lrqad@deped.gov.ph * blr.lrpd@deped.gov.ph
Telefax: (632) 8634-1072; 8634-1054; 8631-4985