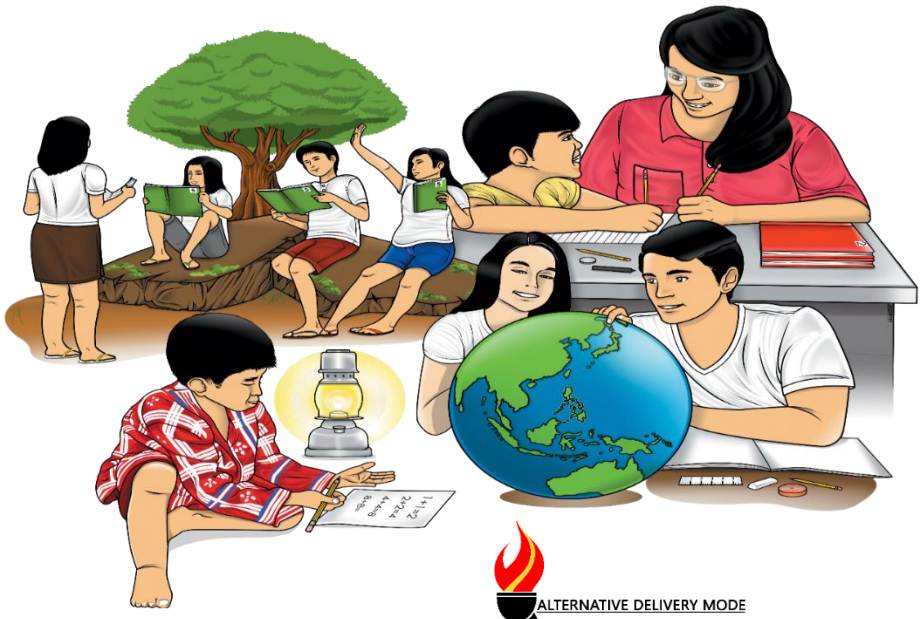
10

Special Program in Technical Vocational Education

Quarter 1 - Module 4
Function of Ignition System

Automotive Servicing NC II



ALTERNATIVE DELIVERY MODE

ADM

10

Special Program in Technical Vocational Education

Quarter 1 - Module 4
Function of Ignition System

Automotive Servicing NC II

DepED
DEPARTMENT OF EDUCATION

IA-Automotive Servicing – Grade 10
Alternative Delivery Mode
Quarter 1 – Module 4: Function of ignition System

Published by the Department of Education
Secretary: Leonor Magtolis Briones
Undersecretary: Diosdado M. San Antonio

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

Printed in the Philippines by:

Department of Education – Cordillera Administrative Region

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 (Removing and Replacing

Batteries). 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.

TABLE OF CONTENTS

LESSON 4 Function of Ignition System

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 explaining the function of ignition system components 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/W4
Learning Competency Code	TLE_IAAUS9-12SIS-IIa-b-6.
Learning Competency	LO 1. Explain the function of ignition system components

Learning Objectives:

a. Identify the types of ignition systems.

b. Explain the component parts of the ignition system.

c. Interpret ignition system diagram.

d. Explain the possible remedies for the identified ignition system troubles.

What I Know

Multiple choice

Direction: Read each question carefully, and choose the letter that corresponds to the **BEST** answer. Write your answer on the answer sheet.

1. In ignition system, the correct sequence of current flow of is:
   a. Battery –Distributor-- Ignition coil -- Spark plug—Ignition switch
   b. Battery – Ignition coil – Distributor – Spark plug –Ignition switch
   c. Battery – Ignition switch – Ignition coil – Distributor--Spark plug
   d. Battery – Spark plug – Ignition coil – Distributor – ignition switch
2. It is a cover which protects the internal parts of the distributor. It has one post for each cylinder and in contact points types ignition system it also has one central post which is connected to the ignition coil to receive the current from it.
   a. Condenser c. Governor
   b. Distributor cap d. Induction coil
3. The distributor serves the following purposes in the ignition system"
   a. It serves as a step up transformer
   b. It distributes high tension current to spark plug at correct time
   c. both (A) and (B)
   d. None of the above
4. The _____ provides a reservoir for the current induced in the primary circuit at the time of the break.
   a. Condenser c. Governor
   b. Distributor d. Induction coil
5. The essential components of ignition system are?
   a. Ballast resistor c. Ignition switch
   b. Battery d. All of the mentioned
6. The following is known as 'Breaker-less Ignition system?
   a. Coil-On-Plug/Direct Ignition System
   b. Conventional Breaker Point Ignition System
   c. Distributor-less/ Waste Spark Ignition System
   d. High Energy/ Electronic Ignition System
7. This is the oldest type of ignition system and has been used since the early days of the automobile, especially through the 1970s?
   a. Coil-On-Plug/Direct Ignition System
   b. Conventional Breaker Point Ignition System
   c. Distributor-less/ Waste Spark Ignition System
   d. High Energy/ Electronic Ignition System

8. This type of ignition system replaces the breaker points and condenser with a transistorized switch within an ignition module?

a. Coil-On-Plug/Direct Ignition System
b. Conventional Breaker Point Ignition System
c. Distributor-less/ Waste Spark Ignition System
d. High Energy/ Electronic Ignition System

9. This type of ignition system also uses a "Waste Spark"?

a. Coil-On-Plug/Direct Ignition System
b. Conventional Breaker Point Ignition System
c. Distributor-less Ignition System
d. High Energy/ Electronic Ignition System

10. A system that is responsible in producing a spark in an engine cylinder at the proper point?

a. Ignition System
b. Charging System
c. Starting System
d. All of the above

11. The ignition system component that set as a transformer to step up(increase) the battery voltage into many thousands of volts

a. Condenser
b. High tension wires
c. Ignition coil
d. Spark plug

12. A removable part that screws into the cylinder head, extending into the combustion chamber and ignites the air-fuel mixture

a. Condenser
b. High tension wires
c. Ignition coil
d. Spark plug

13. The circuit that is consists of a battery, ignition switch, contact points or electronic switching circuits, and coil primary wiring?

a. Primary circuit
b. Primary winding
c. Secondary circuit
d. Secondary winding

14. It is the high voltage side of an ignition system. It consists of ignition coil secondary winding, coil cable, rotor, distributor cap, spark plug cables, spark plugs.

a. Primary circuit
b. Primary winding
c. Secondary circuit
d. Secondary winding

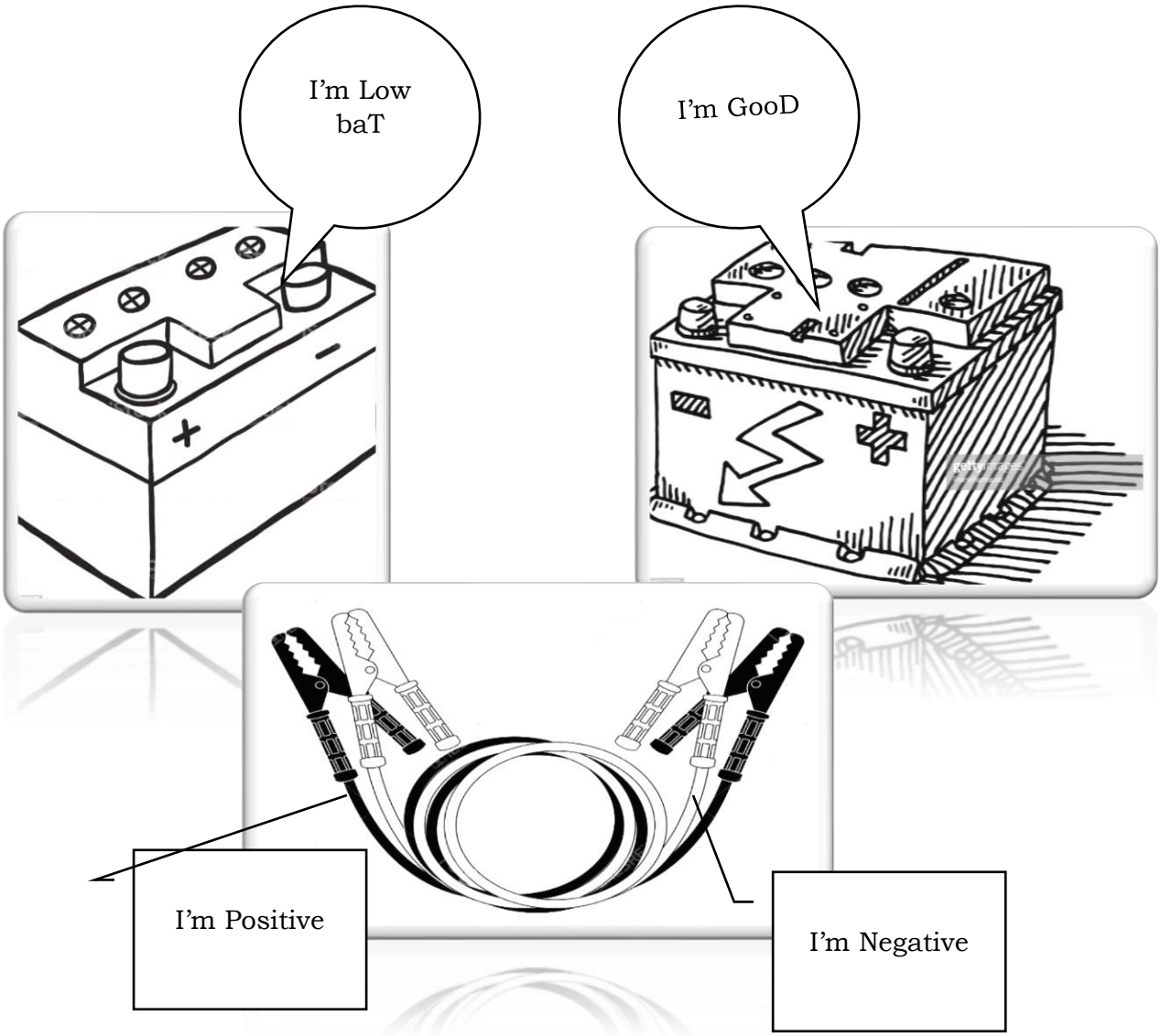
15. The basic test to determine why a vehicle won't start is what we call spark test.

a. Battery test
b. Leakage test
c. Spark Test
d. all of the above

What's In

Assuming that your vehicle won't start and the only remedy is to jump start your vehicle.

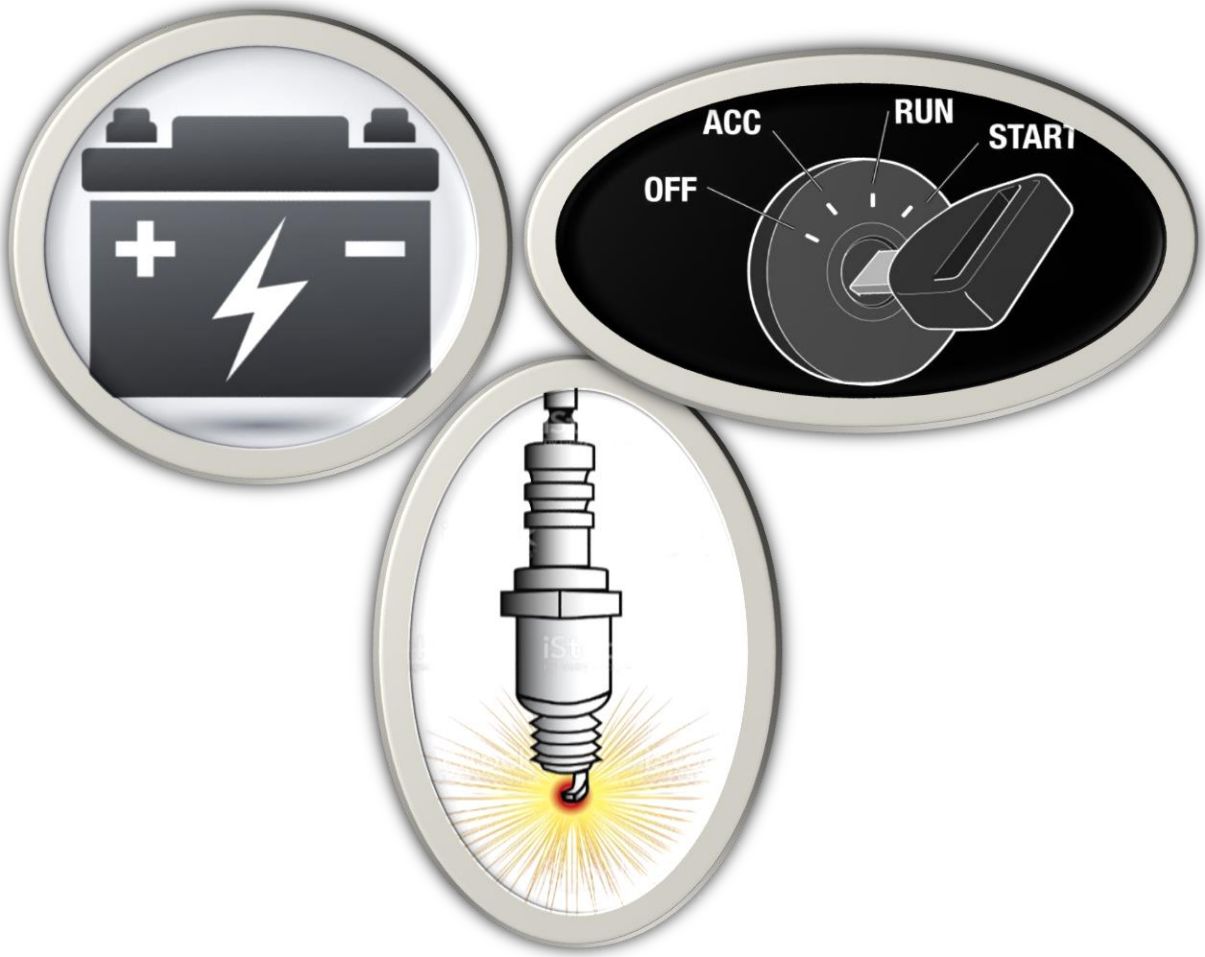
Directions: Draw and connect the battery terminals when doing a jump start.



What's New

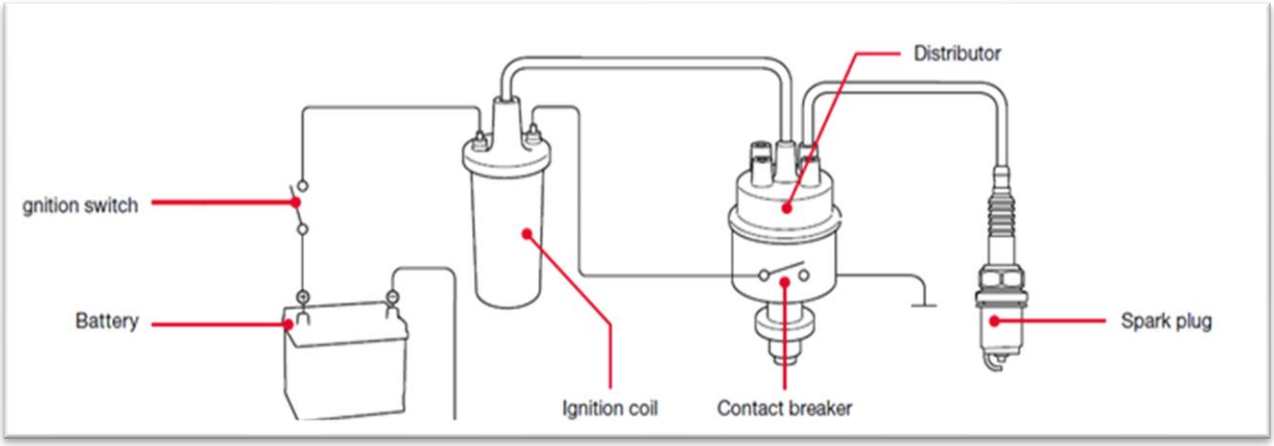
Title of the Activity: Three Pics Two Words

Direction: Observe carefully the given pictures then guess what was being described. Write your answer in the answer sheet.



What Is It

IGNITION SYSTEM



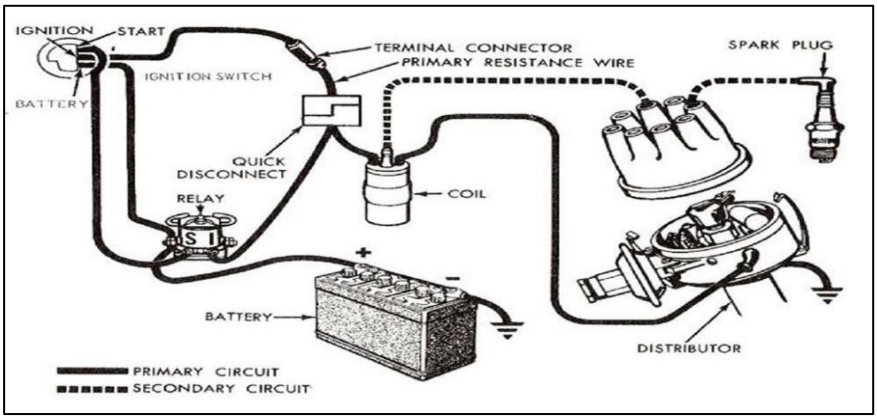
Ignition system function is to ignite the compressed air fuel mixture in the combustion chambers. This should occur at the proper time for combustion begin. To start combustion, the ignition system delivers an electric spark that jumps a gap at the combustion chambers ends of the spark plug. The heat from this arc ignites the compressed air-fuel mixture. The mixture burns, creating pressure that pushes the piston the cylinder so the engine runs.

I- TYPES OF IGNITION SYSTEMS

Currently, we recognize four types of ignition systems used in most cars and trucks: conventional breaker-point ignitions, high energy (electronic) ignitions, distributor-less (waste spark) ignition and coil-on-plug ignitions.

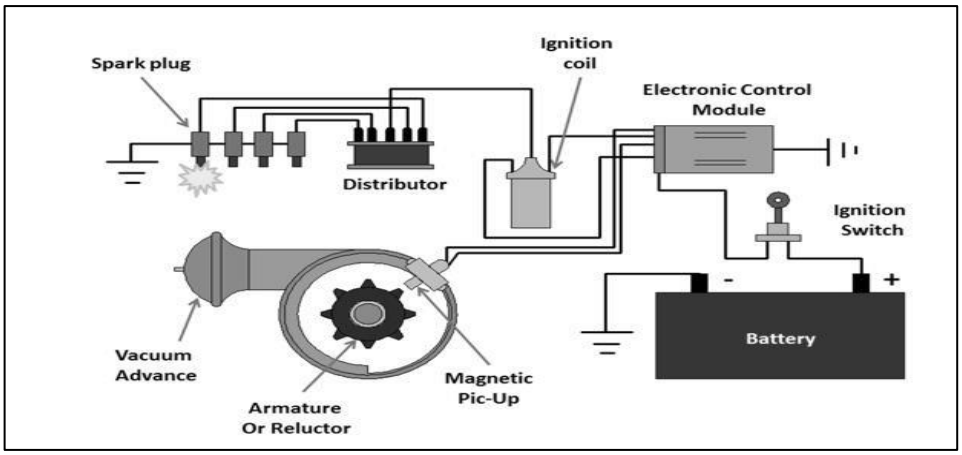
1. Conventional Breaker-Point Ignition System

This is the oldest type of ignition system and has been used since the early days of the automobile, especially through the 1970s. The mechanical nature of these ignition systems, as well as the length of time these systems have been used, they are relatively easy to diagnose and repair. However, they do incorporate a large number of moving parts, increasing the potential for breakdowns.



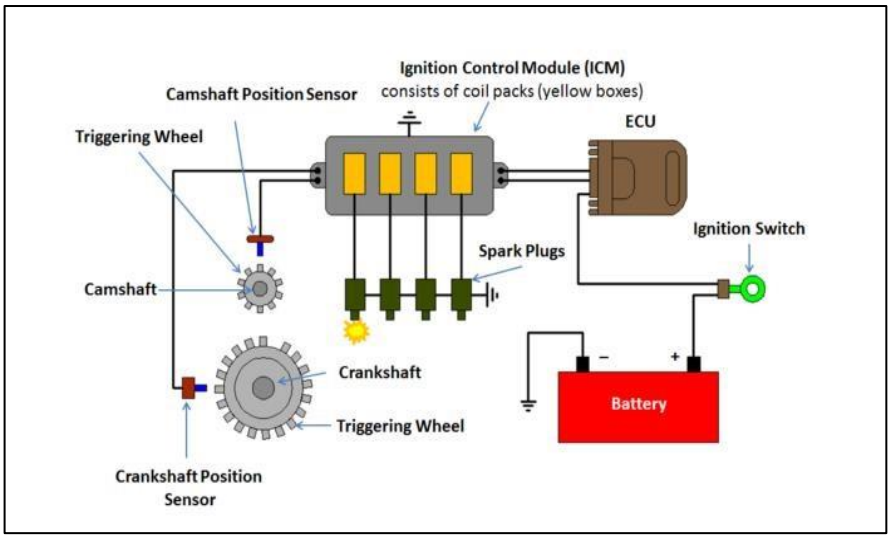
2. High Energy (Electronic) Ignition System

This system replaces the breaker points and condenser with a transistorized switch within an ignition module that also handles the task of triggering the ignition coil to generate high-voltage current. This can prove advantageous, as the use of this electronic switch means there are fewer moving parts than in a breaker-point ignition system while still being relatively easy to diagnose and repair. They can also provide a consistent, high voltage spark throughout the life of the engine, meaning fewer misfires.



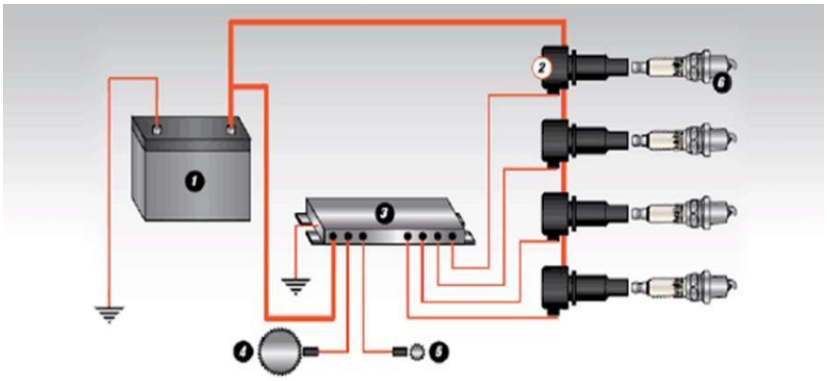
3. Distributor-less (Waste Spark) Ignition System

Multiple ignition coils are used for each pair of cylinders. Using engine sensors to determine crankshaft position and camshaft position, an Electronic Control Unit triggers the appropriate ignition coil and directs the distribution of electrical current to the spark plugs. This system also uses a "Waste Spark" for one of the paired cylinders, pairing two pistons that will be at the top dead center at the same time—one at the end of its compression stroke, and the other at the end of its exhaust stroke. Each of the spark plugs in these cylinders will fire at the same time using the high voltage from one coil.



4. Coil-On-Plug (Direct) Ignition System

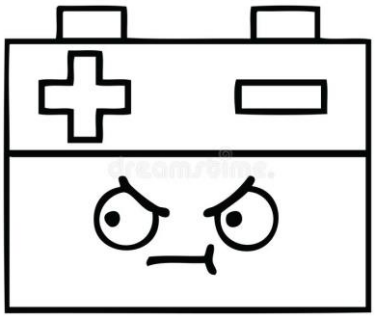
The most sophisticated of all ignitions systems, this system places an ignition coil directly on the top of each spark plug and is ideal for modern engines. All of the ignition timing is handled by the Engine Control Unit, based on input from various sensors.



Coil On Plug (Direct) Ignition

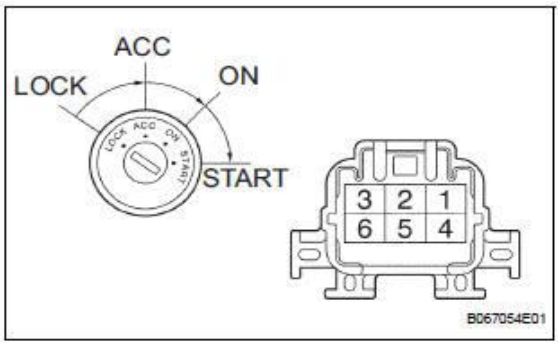
II- BASIC COMPONENTS OF THE IGNITION SYSTEM

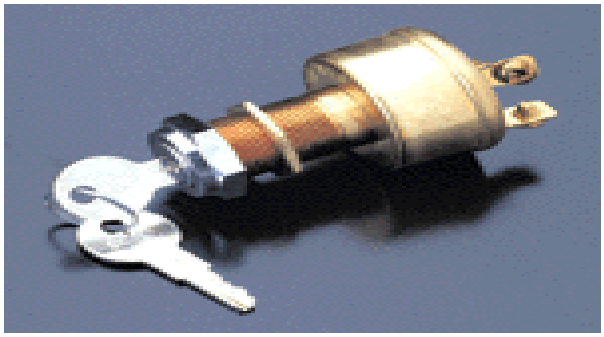
1. Battery -supplies current to starter in order to crank the engine for operation. It also supplies the required electric current to the ignition system.



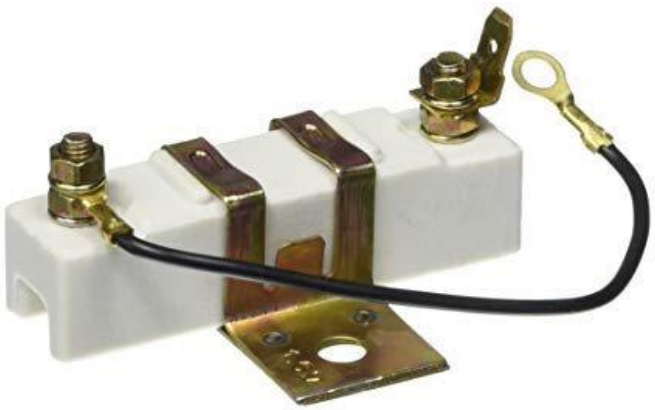
2. Ignition Switch. Your ignition switch does at least three things:

- It turns on the car's electrical system so that all accessories can be operated.
- It turns on the entire primary ignition system.
- It energizes the starter.

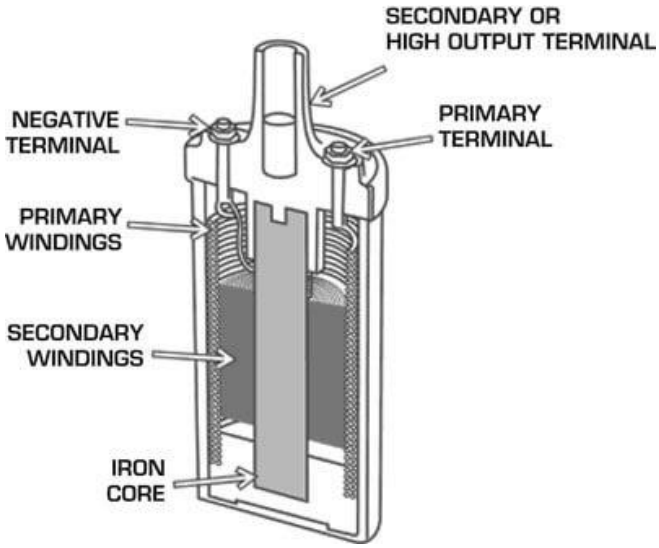




3. Ignition Resistor - a resistor connected into the ignition primary circuit to reduce battery voltage to the coil during engine operation. But in Electronic ignition systems where breaker points were not utilized, ballast resistor therefore is not actually needed.

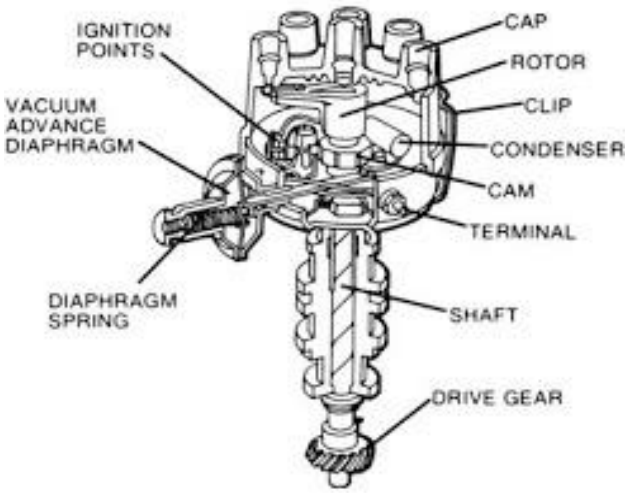


4. Ignition Coil - the ignition system component that set as a transformer to step up(increase) the battery voltage into many thousands of volts.



An ignition coil consists of a laminated iron core surrounded by two coils of copper wire. The **primary winding has relatively few turns of heavy** wire. The secondary winding consists of thousands of turns of smaller wire, insulated from the high voltage by enamel on the wires and layers of oiled paper insulation.

5. Distributor Assembly- A component of the ignition system that determines the firing order of the cylinders. It also directs electrical current to the correct spark plug at precisely the right time.



BASIC PARTS OF A DISTRIBUTOR

a. Distributor Cap

It is a cover which protects the internal parts of the distributor. It has one post for each cylinder and in contact points types ignition system it also has one central post which is connected to the ignition coil to receive the current from it.

b. Rotor

The rotor is present at the top of the distributor shaft. It is driven by the camshaft of engine and hence synchronized to it. The rotating parts of the distributor assembly that distributes high voltage from coil center cable to different spark plug.

c. Contact Breaker/ Contact Point

It is mechanically designed breaker point. It's one end is fixed and other end is movable. It is attached to the breaker assembly. Its main function is to makes and breaks the primary circuit current.

d. Distributor Shaft

It is a shaft which lies in the middle of the ignition distributor. It is connected directly to the camshaft of the engine through a gear drive. It consists of a cam which is used to break the point of the contact breaker.

e. Cam

It is attached to the distributor shaft and rotates with it. It has lobes which are used to open the contact breaker point. The number of lobes is equal to the number of engine cylinder. As the cam rotates, it pushes the cam follower and the breaker points moves apart leads to breaking of current.

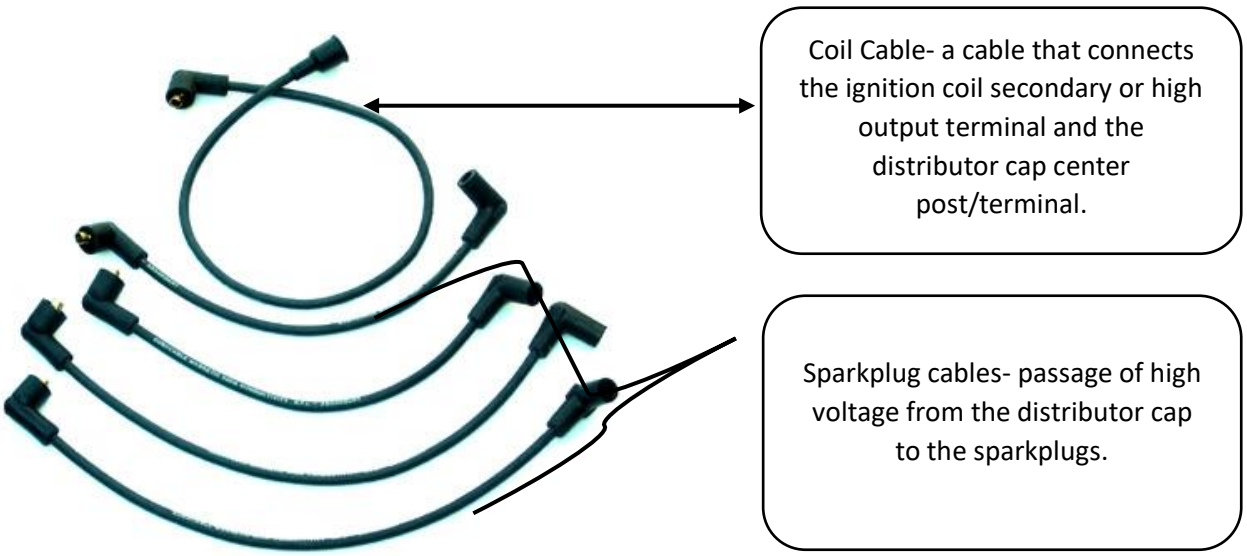
f. Capacitor/Condenser

It is used to prevent the overheating of the contact point of the contact breaker. It helps in production of high voltage current by reverse the current flow through the primary coil. Condenser connected across the contact point to prevent arcing and burning. It also provides the storage of electricity when breaker point is open.

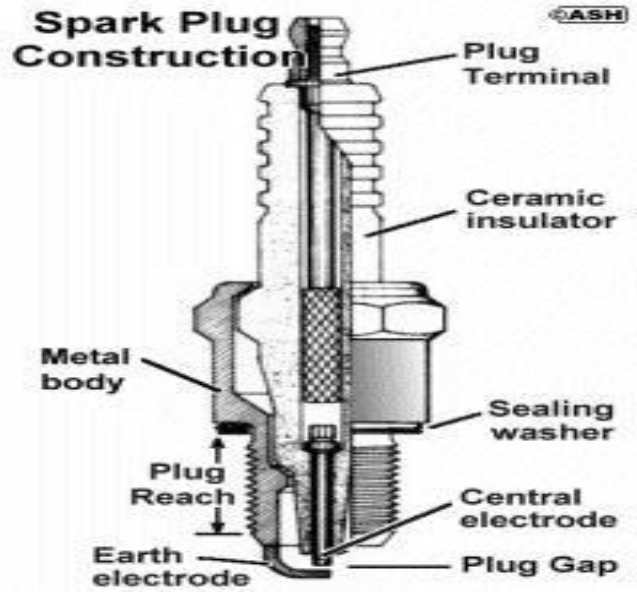
g. Spark Advance Mechanism

It is a mechanism which is used to advance the spark in the spark ignition engine. We have generally two types spark advance mechanism and i.e. centrifugal advance spark and vacuum spark advance mechanism.

6. High Tension Wires-bridges of high voltage and is made up of a coil cable or a spark plug cable.



7.Spark Plug -a removable part that screws into the cylinder head, extending into the combustion chamber and ignites the air-fuel mixture



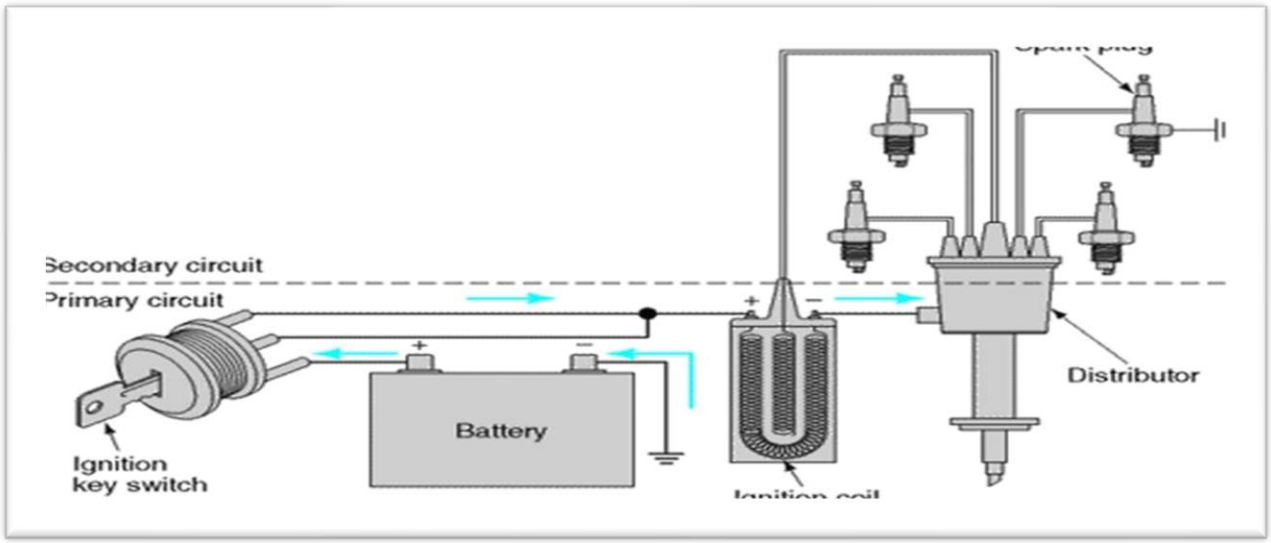
Spark plug consists of an outer metal shell (metal body) with one electrode (earth electrode) and a center ceramic insulator with another electrode (central electrode). The electrodes are separates by a small air gap (plug gap), across which a high-voltage current can arc.

III-TWO ELECTRICAL CIRCUIT OF IGNITION SYSTEM

Ignition system is divided into two electrical circuits - the primary and secondary circuits.

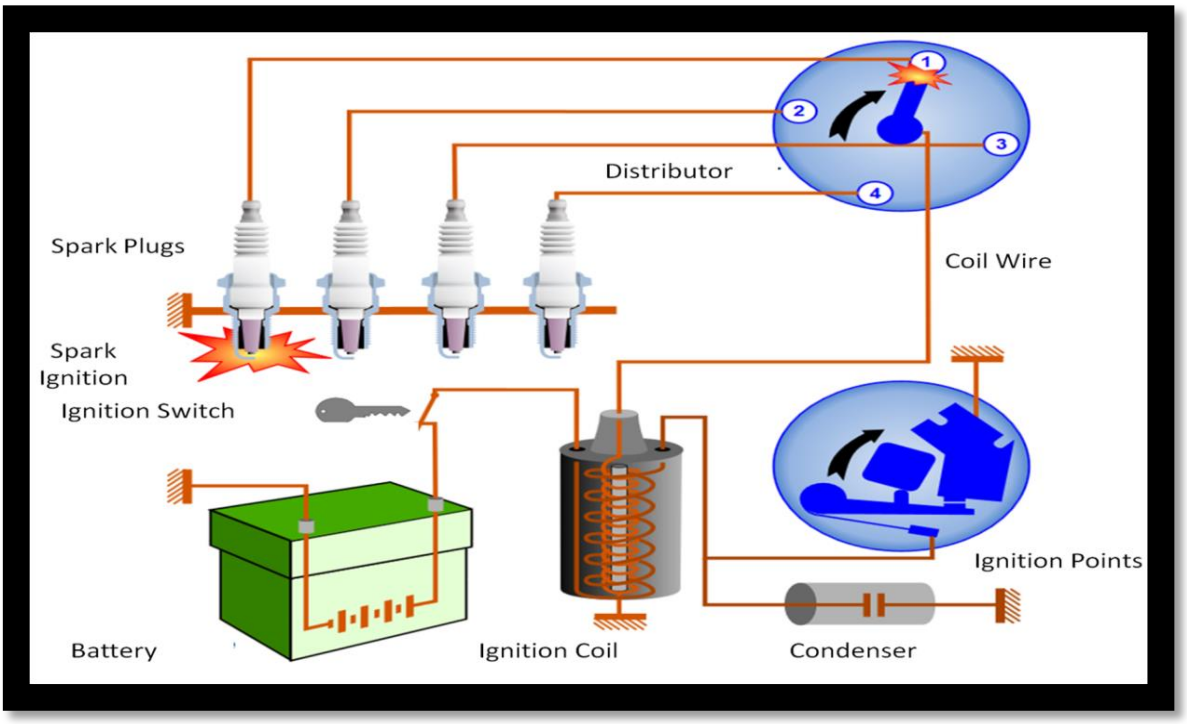
Primary Circuit- The primary circuit carries low voltage. The primary circuit consists of the battery, ignition switch, contact points or electronic switching circuits, and coil primary wiring

Secondary Circuit - high voltage side of an ignition system. It is consists of ignition coil secondary winding, coil cable, rotor, distributor cap, spark plug cables, spark plugs.



Primary and Secondary Circuit Diagram

IV-INTERPRET IGNITION SYSTEM DIAGRAM



1. When the breaker points are close, electric current flows from the battery through the primary windings in the ignition coil and through the points back to the ground. This is called the primary circuit.
2. When a high lobe of the cam pushes on the pivot arm and opens the points, the primary circuit is broken. The magnetic field that was built up in the coil while the primary current was flowing now collapses, including the voltage in the secondary windings as the collapsing magnetic lines of force sweep across them.
3. Because there are many more secondary windings than primary windings, the induced voltage is much higher than the voltage that drove the primary current.
4. This high voltage is sent through the center wire of the coil to the center of the distributor cap, which is always in contact with the rotor.
5. The outer end of the rotor is timed to arrive at the proper moment at the connection to the sparkplug where a spark is desired.
6. To obtain the correct spark, the distance between the two electrodes of the spark plug must be “gapped” correctly. The gap is shown exaggerated for clarity.
7. Cars today use electronic means rather than mechanical breaker points to bring about the “make and break” effect.

V- COMMON VEHICLE PROBLEM REGARDING IGNITION SYSTEM AND HOW TO FIX THEM

The Engine Won't Start

Two possible actions when starting an Engine

1. Engine cranks normally but does not start.

The basic test to determine why a vehicle won't start is what we call spark test.

Procedures/ Steps

a. Pull the spark plug cable of any of the spark plugs.
b. Insert a screw driver into the spark plug boot.
c. Placed the metal shrank approximately ¼ inch from the engine block or cylinder head.
d. Crank the engine then observed if a spark will jump the gap (between metal shrank of the screw driver and the cylinder head or block)
e. The spark should continue to jump the gap as the cable is raised/moved up to ½ inch away. If not, inspect the cable, distributor cap, and rotor.
f. If no spark is observed, replaced the spark plug cable and try another cables. Ignition spark should be present at all cables.
g. If no spark is observed from all spark plug cables, remove the coil cable from the distributor cap then do step C-D to check for spark.
h. If still no spark is being observed from the coil cable, check the ignition connection for possible loose or broken connection.

2. Engine cranks slowly

Asses the battery, connections of the battery cable clamp and the battery terminal must be slightly tight and free of corrosion, and is properly charged to be able to run the engine.

What's More

Directions: Read and analyze each statements. Write your answer on the answer sheet.

1. Supposed you have a vehicle which does not start but the engine cranks normally. What would be the possible problem and what are the procedures/remedies in assessing the problem?

_____
_____
_____
_____

2. Supposed the engine cranks slowly. What would be the possible problem and what are the remedies?

_____
_____
_____
_____
_____

What I Have Learned

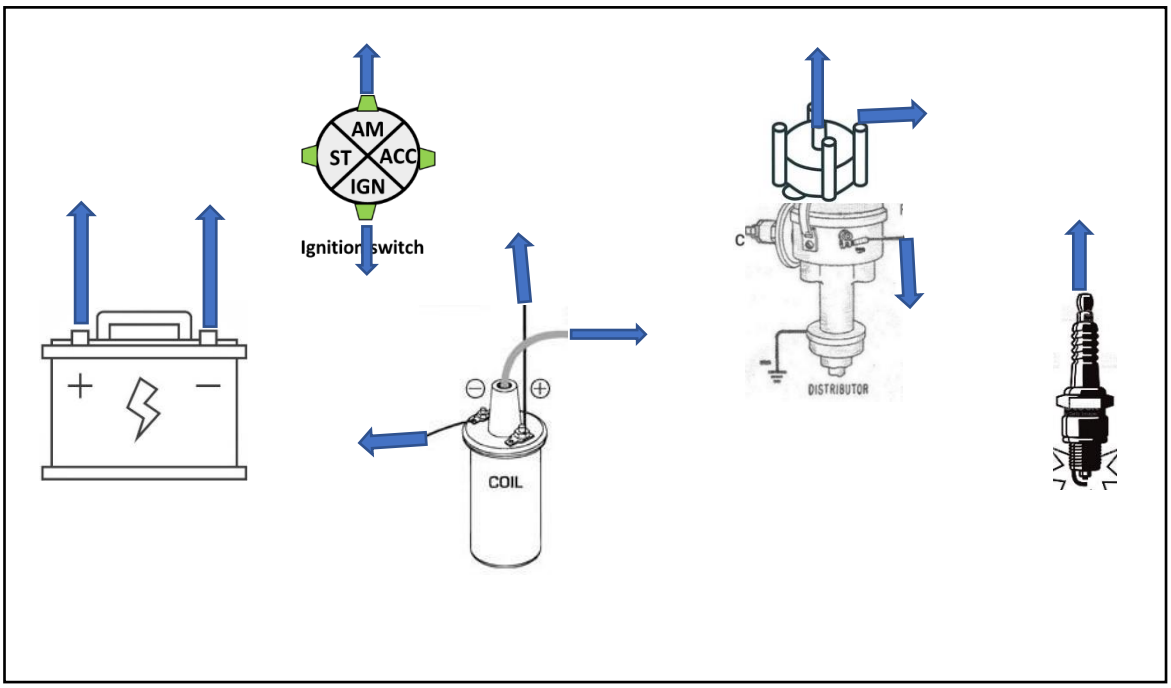
In an engine, a powerful spark is what burns the fuel charge in the combustion chamber. If the spark is not that strong enough then it may not burn the fuel charge and may result in an engine not to start.

Directions: As a student where does the motivation(spark) comes from and what makes that motivation(spark) so powerful that you choose to continue your study during this time of pandemic? Write your answers in the answer sheet you have provided.

_____
_____
_____
_____

What I Can Do

Direction: Copy and connect each terminal to complete the diagram of an ignition system in your answer sheet. Connect ONLY the terminals that have arrows.



Post-Assessment

Multiple choice

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

1. A system that is responsible in producing a spark in an engine cylinder at the proper point?
   a. Ignition System
   b. Charging System
   c. Starting System
   d. All of the above
2. The following is known as 'Breaker-less Ignition system?
   a. Coil-On-Plug/Direct Ignition System
   b. Conventional Breaker Point Ignition System
   c. Distributor-less/ Waste Spark Ignition System
   d. High Energy/ Electronic Ignition System
3. This is the oldest type of ignition system and has been used since the early days of the automobile, especially through the 1970s?
   a. Coil-On-Plug/Direct Ignition System
   b. Conventional Breaker Point Ignition System
   c. Distributor-less/ Waste Spark Ignition System
   d. High Energy/ Electronic Ignition System
4. This type of ignition system also uses a "Waste Spark"?
   a. Coil-On-Plug/Direct Ignition System
   b. Conventional Breaker Point Ignition System
   c. Distributor-less Ignition System
   d. High Energy/ Electronic Ignition System
5. This type of ignition system replaces the breaker points and condenser with a transistorized switch within an ignition module?
   a. Coil-On-Plug/Direct Ignition System
   b. Conventional Breaker Point Ignition System
   c. Distributor-less/ Waste Spark Ignition System
   d. High Energy/ Electronic Ignition System
6. In ignition system, the correct sequence of current flow of is:
   a. Battery –Distributor-- Ignition coil -- Spark plug—Ignition switch
   b. Battery – Ignition coil – Distributor – Spark plug –Ignition switch
   c. Battery – Ignition switch – Ignition coil – Distributor--Spark plug
   d. Battery – Spark plug – Ignition coil – Distributor – ignition switch

7. The basic test to determine why a vehicle won't start is what we call spark test.

a. Battery test c. Spark Test

b. b. Leakage test d. all of the above

8. It is a cover which protects the internal parts of the distributor. It has one post for each cylinder and in contact points types ignition system it also has one central post which is connected to the ignition coil to receive the current from it.

a. Condenser c. Governor

b. Distributor cap d. Induction coil

9. The distributor serves the following purposes in the ignition system"

a. It serves as a step up transformer

b. It distributes high tension current to spark plug at correct time

c. both (A) and (B)

d. None of the above

10. The _____ provides a reservoir for the current induced in the primary circuit at the time of the break.

a. Condenser c. Governor

b. Distributor d. Induction coil

11. The essential components of ignition system are?

a. Ballast resistor c. Ignition switch

b. Battery d. All of the mentioned

12. The ignition system component that set as a transformer to step up(increase) the battery voltage into many thousands of volts

a. Condenser c. Ignition coil

b. High tension wires d. Spark plug

13. A removable part that screws into the cylinder head, extending into the combustion chamber and ignites the air-fuel mixture

a. Condenser c. Ignition coil

b. High tension wires d. Spark plug

14. The circuit that is consists of a battery, ignition switch, contact points or electronic switching circuits, and coil primary wiring?

a. Primary circuit c. Secondary circuit

b. Primary winding d. Secondary winding

15. It is the high voltage side of an ignition system. It consists of ignition coil secondary winding, coil cable, rotor, distributor cap, spark plug cables, spark plugs.

a. Primary circuit c. Secondary circuit

b. Primary winding d. Secondary winding

Additional Activity

Direction: Enumerate at least five parts of distributor assembly in your answer sheet.
1. 2. 3. 4. 5.

Answer Key

What I Know

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

What's in

What's New

The three pictures are all about Ignition System which will be the content of this module

What's More

1.Electrical connection/No Spark Procedures:
A.Pull the spark plug cable of any of the spark plugs.
B. Insert a screw driver into the spark plug boot.
C. Placed the metal shrank approximately ¼ inch from the engine block or cylinder head.
D. Crank the engine then observed if a spark will jump the gap (between metal shrank of the screw driver and the cylinder head or block).
E. The spark should continue to jump the gap as the cable is raised/moved up to ½ inch away. If not, inspect the cable, distributor cap, and rotor.If no spark is observed, replaced the spark plug cable and try another cables. Ignition spark should be present at all cables. If no spark is observed from all spark plug cables, remove the coil cable from the distributor cap then do step C-D to check for spark.If still no spark is being observed from the coil cable, check the ignition connection for possible loose or broken connection.
2.Battery
Asses the battery, connections of the battery cable clamp and the battery terminal must be slightly tight and free of corrosion, and is properly charged to be able to run the engine.

Post Assessment

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

What I Can Do

What I Have Learned

Answers may vary

Additional Activity

1. Distributor Cap
2. Rotor
3. Contact
4. Breaker/
Contact Point
5. Distributor
Shaft
6. Cam
7.Capacitor/Cond
enser
8. Spark Advance
Mechanism:

References

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

Strengthened Technical - Vocational Education Program (STVEP)– Competency- Based Learning Materials (CBLM).

http://www.worldphaco.net/uploads/CAPACITIVE_DISCHARGE_IGNITION_vs_MA GNETIC_DISCHARGE_IGNITION

https://www.worldcat.org/search?q=ti%3Aautomotive+electrical+systems+au%3Ae merson&qt=advanced&dblist=638

https://www.worldcat.org/search?q=ti%3AAn+engineer%27s+guide+to+vehicle+ele ctrical+systems+au%3AWilliamson&qt=advanced&dblist=638

http://mgaguru.com/mgtech/ignition/ig108.htm

http://www.rtftechnologies.org/emtech/coil-driver.htm

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