BA SANGAM COLLEGE

YEAR 13

APPLIED TECHNOLOGY

WORKSHEET 3

Subject: Applied Technology		**Year/Level:** 13
Week: 3	**Lesson 1**	**Date:**
Topic: **Motorized Machines and Engines**		

Previous Knowledge

Students have some prior knowledge on topic which was done last year in Year/Level 12/ 2019.

Learning Outcomes

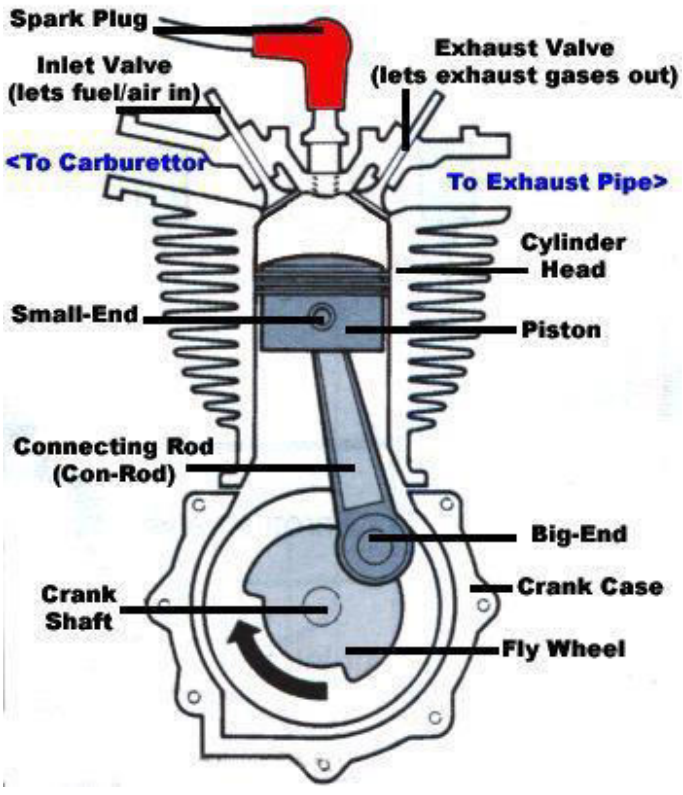
STRAND OUTCOME

After completing this strand students will be able to:

- Identify and familiarize themselves with motorized machines and four stroke engines.
- Exhibit competence incorporated in their appropriate, safe and effective uses.

Four –Stroke Engines

A **four-stroke engine** (also known as **four cycle**) is an internal combustion (IC) engine in which the piston completes four separate strokes while turning a crankshaft. A stroke refers to the full travel of the piston along the cylinder, in either direction. The four separate strokes are termed:



Intake: also known as induction or suction This stroke of the piston begins at top dead center (T.D.C.) and ends at bottom dead center (B.D.C.). In this stroke the intake valve must be in the open position while the piston pulls an air-fuel mixture into the cylinder by producing vacuum pressure into the cylinder through its downward motion.

Compression: This stroke begins at B.D.C, or just at the end of the suction stroke, and ends at T.D.C. In this stroke the piston compresses the air-fuel mixture in

preparation for ignition during the power stroke (below). Both the intake and exhaust valves are closed during this stage.

Combustion: also known as power or ignition This is the start of the second revolution of the four stroke cycle. At this point the crankshaft has completed a full 360 degree revolution. While the piston is at T.D.C. (the end of the compression stroke) the compressed air-fuel mixture is ignited by a spark plug (in a gasoline engine) or by heat generated by high compression (diesel engines), forcefully returning the piston to B.D.C. This stroke produces mechanical work from the engine to turn the crankshaft.

Exhaust: also known as outlet. During the *exhaust* stroke, the piston once from B.D.C. to T.D.C. while the exhaust valve is open. This action expels the spent air-fuel mixture through the exhaust valve.

Main Parts of an Internal Combustion Engine:

1. Cylinder block

Cylinder is the main body of IC engine. Cylinder is a part in which the intake of fuel, compression of fuel and burning of fuel take place. The main function of cylinder is to guide the piston. It is in direct contact with the products of combustion so it must be cooled. For cooling of cylinder a water jacket (for liquid cooling used in most of cars) or fin (for air cooling used in most of bikes) are situated at the outer side of cylinder. At the upper end of cylinder, cylinder head and at the bottom end crank case is bolted. The upper side of cylinder is consists of a combustion chamber where fuel burns. To handle all this pressure and temperature generated by combustion of fuel, cylinder material should have high compressive strength. So it is made by high grade cast iron. It is made by casting and usually cast in one piece.

2. Cylinder head

The top end of cylinder is closed by means of removable cylinder head. There are two holes or ports at the cylinder head, one for intake of fuel and other for exhaust. Both the intake and exhaust ports are closed by the two valves known as inlet and exhaust valve. The inlet valve, exhaust valve, spark plug, injector etc. are bolted on the cylinder head. The main function of cylinder head is to seal the cylinder block and not to permit entry and exit of gases on cover head valve engine. Cylinder head is usually made by cast iron or aluminum.

It is made by casting or forging and usually in one piece.

Piston

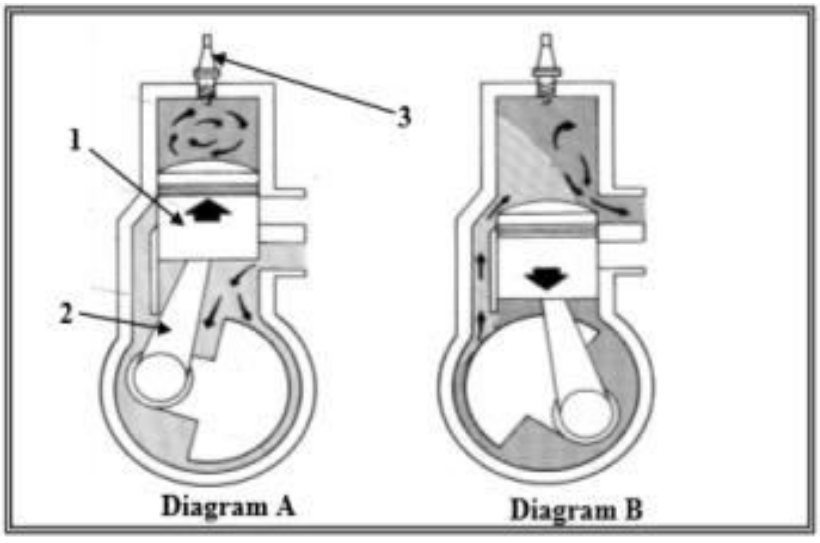
A piston is fitted to each cylinder as a face to receive gas pressure and transmit the thrust to the connecting rod. It is the prime mover in the engine. The main function of piston is to give tight seal to the cylinder through bore and slide freely inside of cylinder. Piston should be light and sufficient strong to handle the gas pressure generated by combustion of fuel. So the piston is made by aluminum alloy and sometimes it is made by cast iron because light alloy piston expands more than cast iron so they need more clearances to the bore.

REVIEW QUESTION

1. Discuss the difference between a two stroke and four stroke engines.

2. List down with their uses the main parts of internal combustions of engines?

(a) Study the cross-sections of a two-stroke internal combustion engine shown below and answer the questions that follow.



(i) Name the parts labelled 1 and 2 in Diagram A.

_____

_____

(ii) Explain the function of the part marked 3.

_____

_____

(iii) Explain one possible problem which can arise if the air filter is blocked.

_____

_____

(iv) Explain the cycle that is taking place in Diagram B.

_____

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(b) (i) Explain how the parts of a two-stroke engine are cooled.

_____

_____

(ii) Explain the function of the crankshaft in a four-stroke engine.

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_____

(iii) State three advantages of a four-stroke engine over a two-stroke engine.

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LESSON PLAN

Subject: Applied Technology		**Year/Level:** 13
Week: 5	**Lesson 2**	**Date:**
Topic: **Motorized Machines and Engines**		

Previous Knowledge

Students have some prior knowledge on topic which was done last year in Year/Level 12/ 2019.

Learning Outcomes

STRAND OUTCOME

After completing this strand students will be able to:

Piston rings

A piston must be a fairly loose fit in the cylinder so it can move freely inside the cylinder. If the piston is too tight fit, it would expand as it got hot and might stick tight in the cylinder and if it is too loose it would leaks the vapor pressure. To provide a good sealing fit and less friction resistance between the piston and cylinder, pistons are equipped with piston rings. These rings are fitted in grooves which have been cut in the piston. They are split at one end so they can expand or slipped over the end of piston. A small two stroke engine has two piston rings to provide good sealing but in a four stroke engine has an extra ring which is known as oil ring. Piston rings are made of cast iron of fine grain and high elastic material which is not affected by the working heat. Sometimes it is made by alloy spring steel.

Connecting rod

Connecting rod connects the piston to crankshaft and transmits the motion and thrust of piston to crankshaft. It converts the reciprocating motion of the piston into rotary motion of crankshaft. There are two end of connecting rod one is known as big end and other as small end. Big end is connected to the crankshaft and the small end is connected to the piston by use of piston pin. The connecting rods are made of nickel, chrome, and chrome vanadium steels. For small engines the material may be aluminum.

Crankshaft

The crankshaft of an internal combustion engine receives the efforts or thrust supplied by piston to the connecting rod and converts the reciprocating motion of piston into rotary motion of crankshaft. The crankshaft mounts in bearing so it can rotate freely. The shape and size of crankshaft depends on the number and arrangement of cylinders. It is usually made by steel forging, but some makers use special types of cast-iron such as spheroidal graphitic or nickel alloy castings which are cheaper to produce and have good service life.

Engine bearing

Everywhere there is rotary action in the engine, bearings need. Bearings are used to support the moving parts. The crankshaft is supported by bearing. The connecting rod big end is attached to the crank pin on the crank of the crankshaft by a bearing. A piston pin at the rod small end is used to attach the rod to the piston, also rides in bearings. The main function of bearings is to reduce friction between these moving parts. In an IC engine sliding and rolling types of bearing used. The sliding type bearing which are sometime called bush is use to attach the connecting rod to the piston and crankshaft. They are split in order to permit their assembly into the engine. The rolling and ball bearing is used to support crankshaft so it can rotate freely. The typical bearing half is made of steel or bronze back to which a lining of relatively soft bearing material is applied.

Crankcase

Body of the engine to which the cylinder are attached and which contains the crankshaft and crankshaft bearing is called crankcase. It serves as the lubricating system too and sometime it is called oil sump. All the oil for lubrication is placed in it.

Valves

To control the inlet and exhaust of internal combustion engine, valves are used. The number of valves in an engine depends on the number of cylinders. Two valves are used for each cylinder one for inlet of air-fuel mixture inside the cylinder and other for exhaust of combustion gases. The valves are fitted in the port at the cylinder head by use of strong spring. This spring keep them closed. Both valves usually open inwards.

Spark plug

It is used in spark ignition engine. The main function of a spark plug is to conduct the high potential from the ignition system into the combustion chamber to ignite the compressed air fuel mixture. It is fitted on cylinder head. The spark plug consists of a metal shell having two electrodes which are insulated from each other with an air gap. When high potential current supply to spark plug it jumping from the supply electrode and produces the necessary spark.

Injector

Injector is usually used in compression ignition engine. It sprays the fuel into combustion chamber at the end of compression stroke. It is fitted on cylinder head.

Manifold

The main function of manifold is to supply the air fuel mixture and collects the exhaust gases equally form all cylinder. In an internal combustion engine two manifold are used, one for intake and other for exhaust. They are usually made by aluminum alloy.

Camshaft

Camshaft is used in IC engine to control the opening and closing of valves at proper timing. For proper engine output inlet valve should open at the end of exhaust stroke and closed at the end of intake stroke. So to regulate its timing, a cam is use which is oval in shape and it exerts a pressure on the valve to open and release to close. It is drive by the timing belt which drives by crankshaft. It is placed at the top or at the bottom of cylinder.

Gudgeon pin or piston pin

These are hardened steel parallel spindles fitted through the piston bosses and the small end bushes or eyes to allow the connecting rods to swivel. It connects the piston to connecting rod. It is made hollow for lightness.

Pushrod

Pushrod is used when the camshaft is situated at the bottom end of cylinder. It carries the camshaft motion to the valves which are situated at the cylinder head

Flywheel

A flywheel is secured on the crankshaft. The main function of flywheel is to rotate the shaft during preparatory stroke. It also makes crankshaft rotation more uniform

This is all about main parts of an internal combustion engine. If you have any query regarding this article ask by commenting.

Working of Four Stroke Diesel Engine

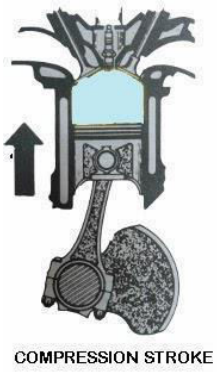
The power generation process in four stroke diesel engine is also divided into four parts. Each part is known as piston stroke. In IC engine, stroke is referred to the maximum distance travel by the piston in a single direction. The piston is free to move only in upward and downward direction. In four stroke engine the piston move two time up and down and the crankshaft move two complete revolution to complete four piston cycle. These are suction stroke, compression stroke, expansion stroke and exhaust stroke

Suction stroke:

In the suction stroke or intake stroke of diesel engine the piston start moves from top end of the cylinder to bottom end of the cylinder and simultaneously inlet valve opens. At this time air at atmospheric pressure drawn inside the cylinder through the inlet valve by a pump. The inlet valve remains open until the piston reaches the lower end of cylinder. After it inlet valve close and seal the upper end of the cylinder.

Compression stroke:

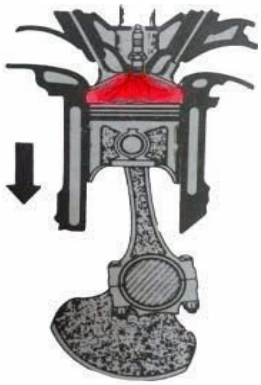
After the piston passes bottom end of the cylinder, it starts moving up. Both valves are closed and the cylinder is sealed at that time. The piston moves upward. This movement of piston compresses the air into a small space between the top of the piston and cylinder head. The air is compressed into 1/22 or less of its original volume. Due to this compression a high pressure and temperature generate inside the cylinder. Both the inlet and exhaust valves do not open during any part of this stroke. At the end of compression stroke the piston is at top end of the cylinder.



COMPRESSION STROKE

Power stroke:

At the end of the compression stroke when the piston is at top end of the cylinder a metered quantity of diesel is injected into the cylinder by the injector. The heat of compressed air ignites the diesel fuel and generates high pressure which pushes down the piston. The connection rod carries this force to the crankshaft which turns to move the vehicle. At the end of power stroke the piston reach the bottom end of cylinder.



POWER STORKE

Exhaust stroke:

When the piston reaches the bottom end of cylinder after the power stroke, the exhaust valve opens. At this time the burn gases inside the cylinder so the cylinder pressure is slightly high from atmospheric pressure. This pressure difference allows burn gases to escape through the exhaust port and the piston move through the top end of the cylinder. At the end of exhaust all burn gases escape and exhaust valve closed. Now again intake valve open and this process running until your vehicle starts.

EXHAUST STROKE

Worksheet

1. Describe the function of the piston.

   _____

   _____

2. Explain with an aid of a sketch one function of oil in a four-stroke engine.

   _____

   _____

   _____

   _____

3. (i) Explain the term bore in relation to a four-stroke engine.

   _____

   _____

   _____

(ii) Distinguish between the two types of piston rings used in a two-stroke engine.

_____

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_____

(iii) Explain how the voltage that causes a spark at the spark plug, is produced in a four-stroke engine.

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LESSON PLAN

Subject: Applied Technology		**Year/Level:** 13
Week: 5	**Lesson 3**	**Date:**
Topic: **Motorized Machines and Engines**		

Previous Knowledge

Students have some prior knowledge on topic which was done last year in Year/Level 12/ 2019.

Learning Outcomes

STRAND OUTCOME

After completing this strand students will be able to:

4 Stroke Engine Advantages and Disadvantages

Four stroke engine is also called four cycle engine. It uses the piston completes four separate strokes—intake, compression, power, and exhaust. **Two-stroke engines** are light weight and groovy power band, but the fact is that 4-stroke engines are preferred for almost every road-going vehicle on the planet.

Advantages

More torque

This is the most important reasons why people choose a 4-stroke engine. The two-stroke boasts its speed and power, but the four-stroke shows extra torque. It is more reliable and quitter.

Last longer

Four stroke engines last longer and use much, much less oil. Compared to two-stroke engines, the four stroke engine is durable for use. The more times an engine goes around, the quicker it will wear out. As 2-strokes must rev to very high RPM to make any power, most applications using them are geared toward maintaining that RPM. Thus, as long as they four-stroke can‘t engine. live

Run much cleaner than 2 strokes

A 2 stroke makes a lot of exhaust smoke because it burns oil mixed with fuel. On the contrary, four-stroke engines have a dedicated oiling system chamber, that‘s which help k to ensure that the only thing burning in the engine is gasoline.

More efficient use of gas

If you have picked up both of them, you may obviously realize the problem. The intake and exhaust accounted 360 °crank angle, the exhaust top dead center the piston upward, the residual gas is exhaust forcibly. When a mixture of fuel and air is forced by atmospheric pressure into the cylinder, the piston down to the intake bottom dead center, the incoming fresh mixture almost combust. Substantially, there is no wasted fresh mixture. However, for two-stroke engine, the fresh mixture is escaping with exhaust gases during exhaust stroke.

Disadvantages

Complicated

Two-stroke engines do not have valves, simplifying their construction. However, there are more parts to worry about in a four-stroke engine which results in harder to troubleshoot.

Half as powerful as two stroke engines

For equivalent engines, the four stroke ones fire once every two revolutions, while two stroke engines are more powerful because every revolution of the engine includes a power stroke.

More expensive than 2 stroke

A four-stroke engine is much more expensive and complex than a two-stroke one. It has more complied with more parts so they often require repairs more often and it is usually more expensive.

Comparison between Two-Stroke and Four-Stroke Engines

Comparison between two-stroke and four-stroke engines can be done in aspects like strokes required for thermodynamic cycle completion, weight of flywheel used, engine size for producing the same power, rate of wear and tear in engine, by identifying valves are present or not, engine cost, volumetric efficiency and thermal efficiency

No.	Two-Stroke Engine	Four-Stroke Engine
01	In two-stroke engine thermodynamics cycle is completed in two strokes of the piston or in one revolution of the crankshaft. Thus there is one power stroke for every revolution of the crankshaft.	In four-stroke engine thermodynamic cycle is completed in four strokes of the piston or in two revolutions of the crankshaft. Thus, one power stroke for every two revolutions of the crankshaft
02	Because of the above, turning moment is more uniform and hence a lighter flywheel can be used.	Because of the above, turning moment is not so uniform and hence a heavier flywheel is required.
03	Again, Because of one power stroke for every evolution, power produced for same size of two-stroke engine is twice, or for the same power of the engine is lighter and more compact.	Because of one power stroke for two revolutions, power produced for same size of four-stroke engine is less or for the same power the engine is heavier and bulkier.
04	Because of one power stroke in one revolution greater cooling and lubrication requirements. Higher rate of wear and tear in two-stroke compared to four stroke engine	Because of one power stroke in two revolutions lesser cooling and lubrication requirements. Lower rate of wear and tear in four-stroke engine.
05	Two-stroke engines have no valves but only ports (some two-stroke engines are fitted with convectional exhaust valve or reed valve).	Four-stroke engines have valves and valve actuating mechanisms for opening and closing of the intake and exhaust valves.
06	Because of light weight and simplicity due to the absence of the valve actuating mechanism, initial cost of the two-stroke engine is less.	Because of comparatively higher weight and complicated valve mechanism, the initial cost of the four-stroke engine is more.
07	Two-stroke engine is used where low cost, Compactness and light weight are important, viz., in scooters, motorcycles, hand sprayers etc.	Four-stroke engine is used where efficiency is important, viz., in cars, buses, tucks, tractors, industrial engines, airplane, power generation etc.
08	Volumetric efficiency is lower due to lesser time for mixture intake.	Volumetric efficiency is higher due to more time for mixture intake.
09	Lesser thermal efficiency is lower; part load efficiency is poor.	Higher thermal efficiency; part load efficiency is better.

Activity

a. Explain briefly the function of the following parts in a small engine.

1. Air cleaner
_____
_____
2. Plug wire
_____
_____
3. Crankshaft
_____
_____

b. Premix fuel which has a mixture of both oil and fuel is used in two stroke engines.

(i) Explain the functions of both the fuel and oil in the running of the two stroke engine.
_____
_____
_____
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(ii) State two reasons why a plug may not spark when starting an engine.
_____
_____
_____
__

(c) Servicing should be done on a regular basis and not until it breaks down.

(i) List the steps involve in servicing the fuel filters
_____
_____
_____
___

(ii) List the steps in servicing the air
_____
_____
_____
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LESSON PLAN

Subject: Applied Technology		**Year/Level:** 13
Week: 5	**Lesson 4**	**Date:**
Topic: **Motorized Machines and Engines**		

Previous Knowledge

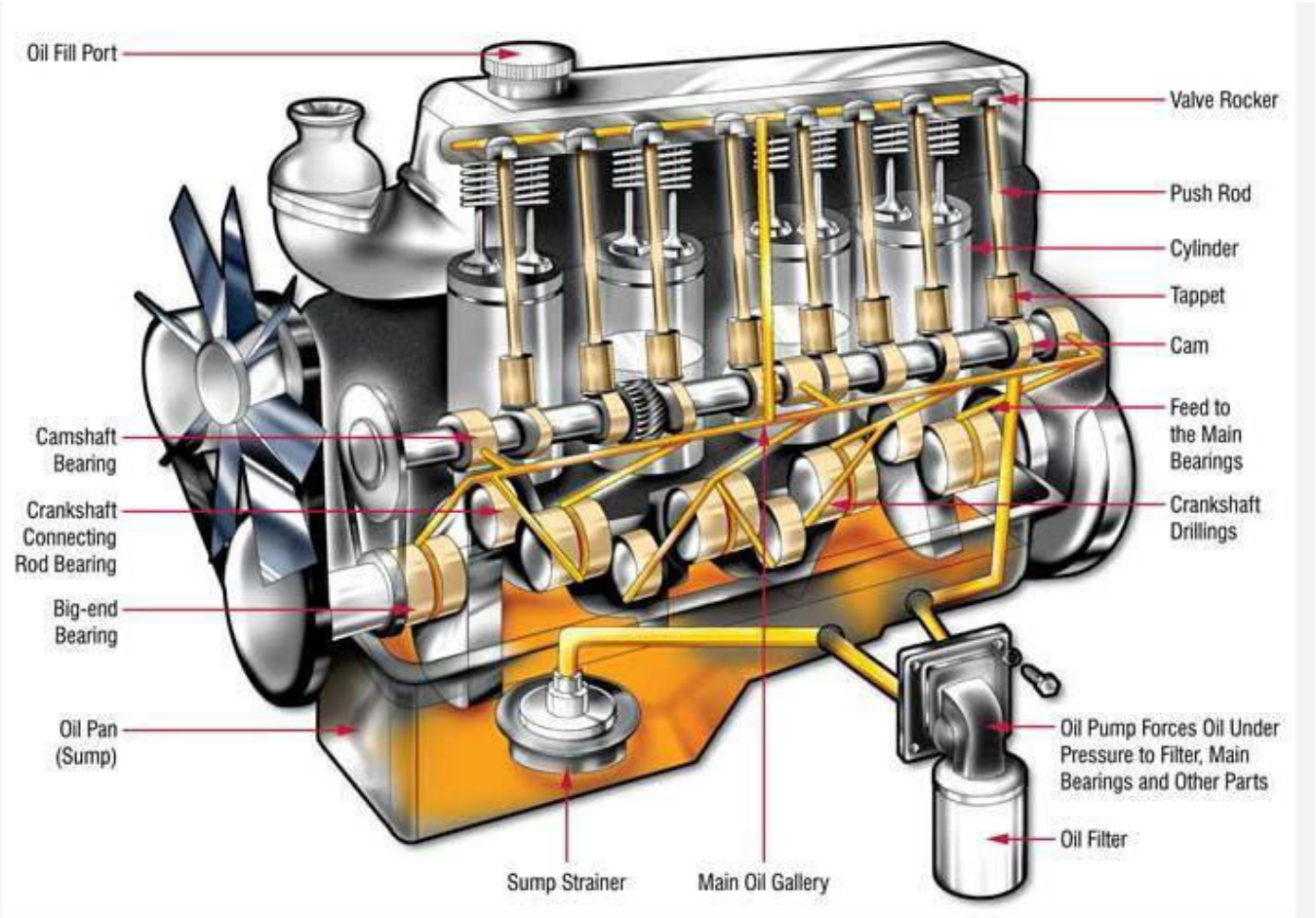
Students have some prior knowledge on topic which was done last year in Year/Level 12/ 2019.

Learning Outcomes

STRAND OUTCOME

After completing this strand students will be able to:

The basic lubrication oiling system



You drive your car every day, isn‘t it nice to the combustion engine works.

You may know about maintaining your car that is you have to change the Engine lubrication oils time to time. What you may not know is where the oil goes, what does it do? and why it needs to be changed time to time? The first task of oil in the engine is to keep the things oily so they could not get dry. Just think for a while if the eardrum-piercing sounds of metal pistons screeching up and down inside a dry cylinder. It will be so annoying, isn‘t it?

There are pleasant effects of keeping the engine lubricated with automotive lubricants. There is little friction, which makes a sense that engine has to make little effort to keep it running. So, it means that it is able to skate on less fuel can run at the lower temperature. And this means that less wear and tear on the engine parts. Engine needs to fill with clean oil so it can perform well.

Never get fooled by the term ―lubrication‖, shop, sometime they recommend you are supposed to have a ―lube job‖ oiling the chassis and suspension system. None of them shares the oil with lubrication system in engine.

Lubrication system

The Engine lubrication system is considered to give a flow to the clean oil at the accurate temperature, with a appropriate pressure to each part of the engine. The oil is sucked out into the pump from the sump, as a heart of the system, than forced between the oil filter and pressure is fed to the main bearings and also to the oil pressure gauge. The oil passes through the main bearings feed- holes into the drilled passages which is in the crankshaft and on to the bearings of the connecting rod. **The bearings of the piston-pin and cylinder walls get lubricated oil which dispersed by the rotating crankshaft**. By the lower ring in the piston the excess being scraped. Each camshaft bearing is fed by the main supply passage from a branch or tributary. And there is another branch which supplies the gears or timing chain on the drive of camshaft. The oil which is excesses then drains back to the sump, where the heat is being transferred to the surrounding air.

Journal Bearings

If the crankshaft journals get worn, the engine will be having very low oil pressure and will throw oil all over inside the engine. The unnecessary splash will overcome the rings and can cause the engine to use that oil. Simply replacing the bearing inserts can restore the worn bearing surfaces. In well maintained engine, bearing wear take places instantly after a cold start because there is less or no oil film between the shaft and bearing. At the time that enough automotive lubricants is dispersed through the hydrodynamic lubrication system apparent and stops the bearing wear progress.

Piston rings - cylinder

A sliding seal avoiding leakage of the air mixture or fuel is provided by piston rings. It gets weaken into the oil sump while combustion and compression from the combustion chamber. On other hand, from leaking into the combustion area they keep oil in the sump, where it will be burned and lost. Those cars that burn oil and have to be added, a quart at every 1,500 miles are flaming it because the rings get no longer to be sealed properly.

Hydrodynamic lubrication prevails in the center of the cylinder wall and the piston rings of the good maintained car, essential for the very lower wear and friction. The thickness of the film becomes assorted and minimal lubrication may exist where the piston will stop to redirect on the top and bottom of the dead centre. To analyze or realize well head transfer from the piston to the cylinder, a finest sealing, a minimal thickness of film and a minimum of oil burning is desirable. Oil controlling ring keeps minimal the thickness of film. This is ring is located after the piston rings so that the surplus oil directly scraped down to the sump. To lubricate the following ring the oil film left on the cylinder wall by the passage of this ring will be available

ACTIVITY

a. Name the parts that provide the following functions in a two-stroke engine:

I.Surrounds and protects all other parts of the engine.

_____
_____

II. Traps dirt and sediment from the gas before it is delivered to the carburetor.

_____
_____
_____
_____

III. Ignites the air/fuel mixture.

_____
_____
_____

b. 1. Sketch and label the exhaust and intake ports of a two-stroke engine.

_____
_____
_____
_____

(iii) Explain how a two-stroke engine is lubricated and cooled

_____
_____
_____
_____
_____

LESSON PLAN

Subject: Applied Technology		**Year/Level:** 13
Week: 5	**Lesson 5**	**Date:**
Topic: **Motorized Machines and Engines**		

Previous Knowledge

Students have some prior knowledge on topic which was done last year in Year/Level 12/ 2019.

Learning Outcomes

STRAND OUTCOME

After completing this strand students will be able to:

Various Lubrication Systems

The various lubrication systems used for lubricating the various parts of engine are classified as

1. Mist lubrication system
2. Wet sump lubrication system, and
3. Dry sump lubrication system.

1. Mist lubrication system:

Mist lubrication system is a very simple type of lubrication. In this system, the small quantity of lubricating oil (usually 2 to 3%) is mixed with the fuel (preferably gasoline). The oil and fuel mixture is introduced through the carburetor. The gasoline vaporized and oil in the form of mist enters the cylinder via the crank base. The droplets of oil strike the crank base. The droplets of oil strike the crank base, lubricate the main and connecting rod bearings and the rest of the oil lubricates the piston, piston rings and cylinder.

The system is preferred in two stroke engines where crank base lubrication is not required. In a two-stroke engine, the charge is partially compressed in a crank base, so it is not possible to have the oil in the crank base.

This system is simple, low cost and maintenance free because it does not require any oil pump, filter, etc. However, it has certain serious disadvantages. Therefore, it is not popular among the lubrication system. Its disadvantages are the following:

1. During combustion in the engine, some lubricating oil also burnt and it causes heavy exhaust and forms deposits on the piston crown, exhaust port and exhaust system.
2. Since the lubricating oil comes in contact with acidic vapours produced during the combustion, it gets contaminated and may result in the corrosion of the bearings surface.
3. When the vehicle is moving downhill, the throttle is almost closed, and the engine suffers lack of lubrication as supply of fuel is less. It is a very serious drawback of this system.
4. There is no control over the supply of lubricating oil to the engine. In normal operating conditions, the two-stroke engines are always over-oiled. Thus consumption of oil is also more.
5. This system requires thorough mixing of oil and fuel prior to admission into the engine. It requires either separate mixing or use of some additives.

2. Wet-sump lubrication system:

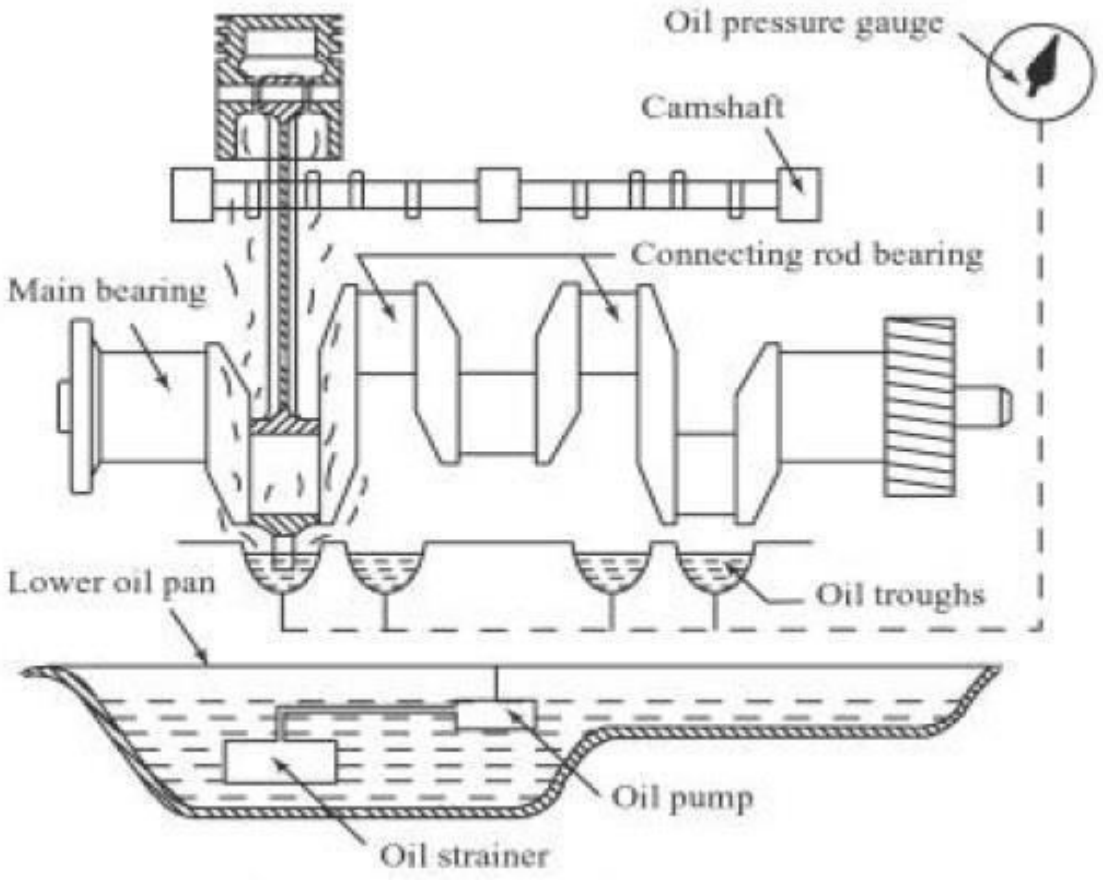
In the **wet-sump lubrication system**, the bottom of the crank case contains an oil pan or sump that serves as oil supply, oil storage tank and oil cooler. The oil dripping from the cylinders, bearings and other parts, fall under gravity back into the sump, from where it is picked up by pump and recirculates through the engine lubrication system. There are three varieties in wet-sump lubrication system. They are:

1. Splash lubrication system
2. Splash and pressure system and
3. Pressurized lubrication system.

4.

2.1 Splash lubrication System:

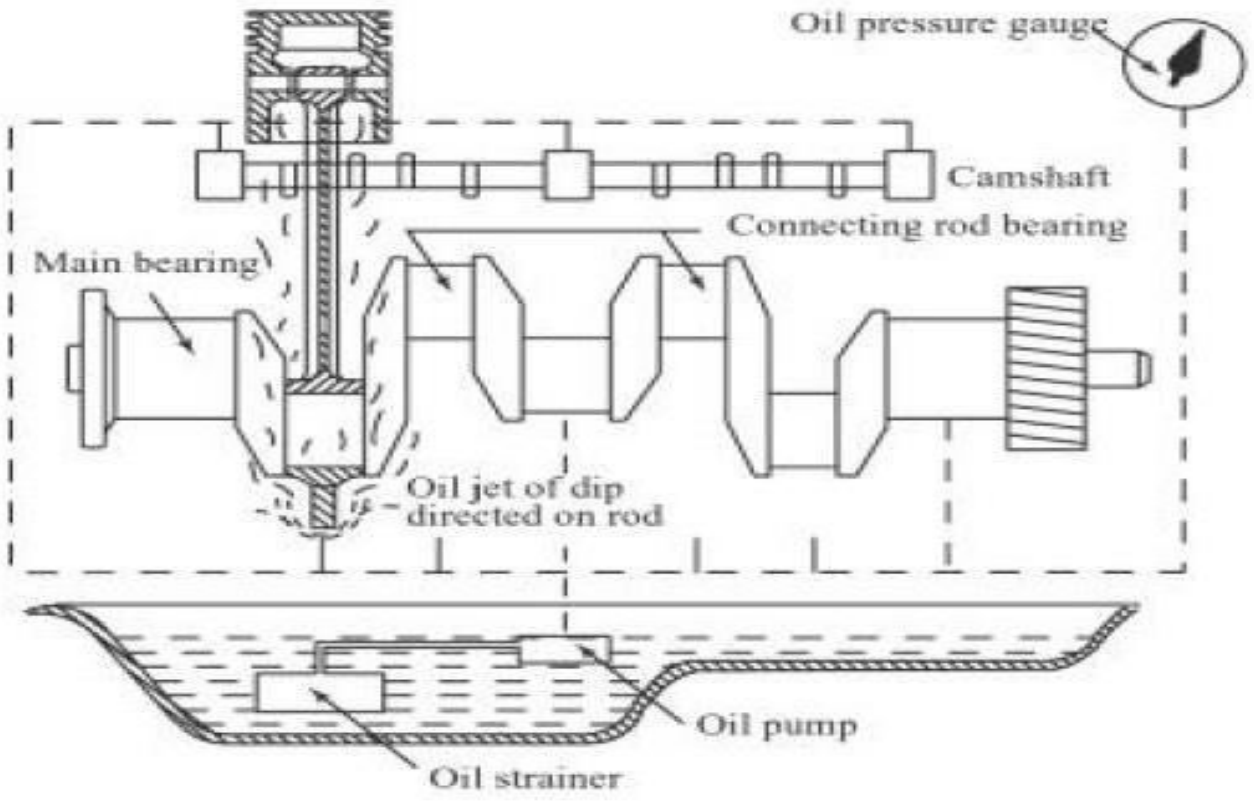
Splash lubrication system is used on small, stationary four-stroke engines. In this system, the cap of the big end bearing on the connecting rod is provided with a scoop which strikes and dips into the oil-filled through at every revolution of the crank shaft and oil is splashed all over the interior of crank case into the piston and over the exposed portion of the cylinder is shown in the figure below.



A hole is drilled through the connecting rod cap through which the oil passes to the bearing surface. Oil pockets are provided to catch the splashed oil over all the main bearings and also the cam shaft bearings. From these pockets oil passes to the bearings through drilled hole. The surplus oil dripping from the cylinder flows back to the oil sump in the crank case.

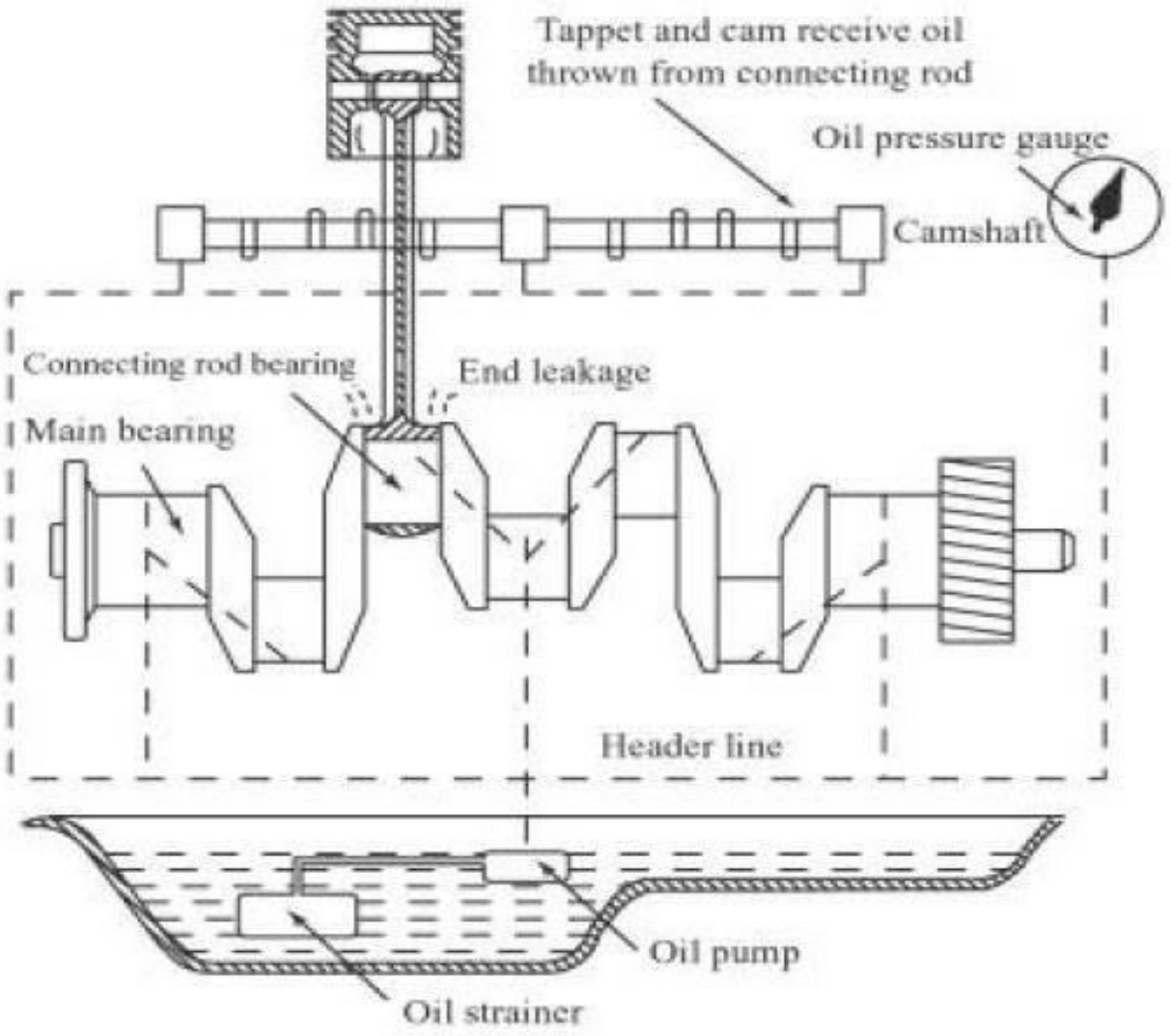
2.2 Splash and pressure lubrication system:

Splash and pressure lubrication system is combination of splash and pressure system as shown in below figure. In this system, the lubricating oil is supplied by a pump under pressure to main and cam shaft bearings. the oil is also directed in the form of spray from nozzle or splashed by a scoop or dipper on the big end to lubricate bearings at the big end of the connecting rod, crank pin, gudgeon pin, piston rings and cylinder.



2.3 Pressurized lubrication system:

In **pressurized lubrication system**, the lubricating oil is supplied by a pump under pressure to all parts requiring lubrication as shown in below figure. The oil under the pressure is supplied to main bearings of the crank shaft and camshaft. Holes drilled through the main crank shaft bearings journals, communicate oil big end bearing and small end bearings through the hole drilled in the connecting rod. a pressure gauge is provided to confirm the circulation of oil to various parts.



This system provides sufficient lubrication to all parts and is favoured by most of the engine manufacturers. This is used in most heavy duty and high-speed engines.

3. Dry-sump lubrication system:

In **dry-sump lubrication system**, the oil supply is carried from an external tank. The oil from the sump is pumped by means of a scavenging pump through filters to the external storage tank. The oil from the storage tank is pumped to engine cylinder through and oil cooler. The oil pressure may vary from 3 to 8 bars.

The dry-sump lubrication system is generally used for heavy-duty engine

Review questions

3. Discuss the difference between a two stroke and four stroke engines.

4. List down with their uses the main parts of internal combustions of engines?

5. Explain the difference between suction stroke and compression stroke?

6. Write down three advantages of a four stroke Engines?

7. Write down three disadvantages of a four stroke Engines?

8. Differentiate mist lubrication system with wet sump lubrication system.

9. Discuss the following:

   a) Splash lubrication system

b) Splash and pressure system

c) Pressured lubrication system.
