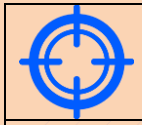
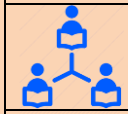
	**Module Focus/Specific Learning Outcomes:** make sure that you write the key unit objectives to be acquired at the end of the unit.
	**Learning Activity:** Complete a learning activity. This will help you to review or practise what you have learned and to prepare you for an assignment or an examination. You will not submit learning activities to your tutor/marker. Instead, you will compare your responses to those provided in the Learning Activity Answer Key found at the end of the applicable module.
	**Video/Flashcard app:** View a video.
	**Stop/Caution:** Use caution when conducting this learning activity or experiment.
	**Assignment:** Complete an assignment. You will submit your completed assignments to your tutor/marker for assessment in accordance with the chart found in the course Introduction.
	**Learning Partner:** Ask your learning partner to help you with this task.
	**Note:** Take note of and remember this important information or reminder.
	**Examination:** Write your final examination at this time.

UNIT 2	VOCABULARY	SKILLS WORK	FUNCTIONS	QUIZ
2 ICE Geometry	Lead-in activity Answer the questions	Reading Read the text (click underlined words to get more info)	Visit the ICE lab and use the service manuals and info databases in order to identify an ICE At the laboratory of ICE, split in teams and each one must match the cards given	Watch carefully the video and name each engine type Solve the crossword, using words from the reading text Self-testing. Match pictures with engine types

In the next Unit, you will learn;

- ICE types by cylinder layout
- Common types of ICE & the exotic Rotary
- Useful informations

UNIT 2

ICE Geometry

- ICE types by cylinder layout
- Common types and Rotary ICE
- Useful informations

1 **Lead-in activity: Look at the picture below and try to guess what it is and what are they doing. Answer the following questions.**

1. Which is the minimum number of cylinders in an ICE?
2. How many cylinders must have an V engine?
3. Which is the angle between cylinders in a boxer or flat ICE?

2

Reading: Read the text carefully.

In engines with more than one cylinder they are usually arranged either in 1 row (or inline) or 2 rows (boxer engine or V engine); 3 rows are occasionally used (W engine) in contemporary engines, and other engine configurations are possible and have been used.

Single cylinder engines are common for motorcycles and in small engines of machinery.

In-line or straight engines have the cylinders arranged, one after the other, in a straight line. Almost all four cylinder engines are a straight/Inline engine is considerably easier to build than an otherwise equivalent Boxer or V type engines because the cylinder bank and crankshaft can be milled from a single metal casting and it requires fewer cylinder heads and camshafts.

This ultimately means lower production and maintenance costs. Also due to their smaller and more lightweight construction, this is the preferred Engine design for FF cars (Front Wheel Drive). The design can be extremely fuel efficient compared to V type, Boxer and Flat engine designs.

The V-type of engine has two rows of cylinders set normally at a ninety degree angle to each other. Advantages include it's short length, great rigidity of the block, its heavy crankshaft, and attractive low profile. This is a tried and tested engine design with huge performance potential.

In sports applications, having the engine as low to the floor as possible increases the car's handling characteristics, as it will naturally have a lower centre of gravity. Also having a strong engine with built in rigidity can mean the difference in endurance races, making the V type engine design an ideal choice for Motorsport applications.

With this type of engine it is possible to have a very high compression ratios, without block distortion under load.

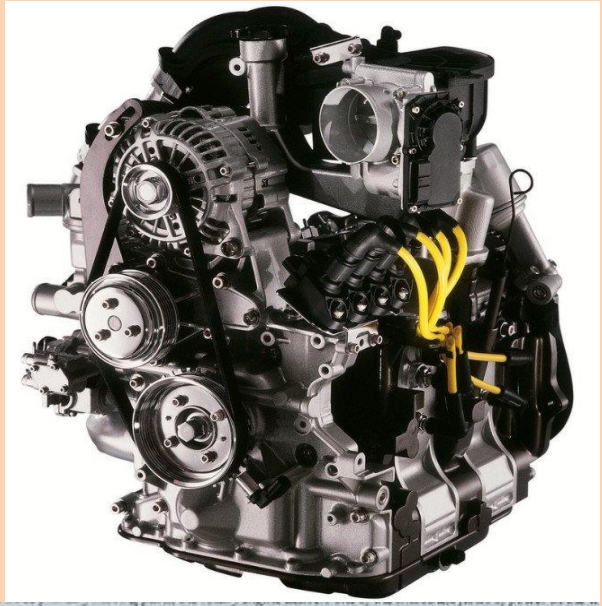
This makes it a strong and robust design for high performance applications and is used in F1 for instance. Also with it's resistance to torsional vibration, the engine characteristics produce a smooth and refined engine.

In 1896, Karl Benz invented the first internal combustion engine with it's horizontally opposed pistons. This Boxer/Flat engine is an design with multiple pistons that all move in the horizontal plane. The most popular and significant layout has cylinders arranged in two banks on either side of a single crankshaft, generally known as "boxers". This is because the two pistons join together in the middle of TDC (Top Dead Centre).

This is similar to two boxers touching gloves at the beginning of a bout and is the origins of the name appointed to the engine design.

Flat engines have a lower center of gravity than any other common configuration, so vehicles using them should benefit from better stability and control during cornering. But they are also wider than more traditional configurations and the extra width causes problems fitting the engine into the engine bay of a front-engine car. Subaru have been producing All Wheel Drive (AWD) front engine cars for some time now, so where there's a will they is a way.

Rotary engine



The Rotary Wankel engine was an early type of internal-combustion engine in which the crankshaft remained stationary and the entire cylinder block rotated around it.

The Rotary/ Wankel engine has no pistons, it uses rotors instead. This engine is small, compact and has a curved, oblong inner shape. Its central rotor turns in one direction only, but it produces all four OTTO strokes (intake, compression, power and exhaust) effectively. The only production car to still have a Rotary/ Wankel engine design in production today is the Masda RX-8 and previous RX-7 models.

The Rotary/ Wankel engine is limited by its inherent restriction on breathing capacity due to the need for the fuel/air mixture to be aspirated through the hollow crankshaft and crankcase, which directly affected its volumetric efficiency, also low torque levels are a known problem and the engine has design limitations. Turbocharging this engine is one of the easiest ways around these deficiencies and was seen in the RX-7.

The rotational forces of the mass of the Rotary/ Wankel engine's weight produce a powerful gyroscopic flywheel effect. This smooths out the power delivery and reduces vibration. Vibration had been such a serious problem on conventional piston engines that heavy flywheels had to be added to the overall engine design to help counteract the effects.

The cylinders themselves functioned as a flywheel; Rotary engines gained a substantial power-to-weight ratio advantage over more conventional engines. Another advantage was improved cooling, as the rotating cylinder block created its own fast-moving airflow, even at standstill.

Dispensing with separate cylinders, pistons, valves and crankshaft, the rotary engine applies power directly to the transmission. It's construction allows it to provide the power of a conventional engine that is twice its size and weight and that has twice as many parts.

The Rotary/ Wankel burns as much as 20% more fuel than the conventional engine and is potentially a higher polluter, but its small size allows the addition of emission-control parts more conveniently than does the piston engine.

The basic unit of the rotary engine is a large combustion chamber in the form of a pinched oval. Within this chamber all four functions of a piston take place simultaneously in the three pockets that are formed between the rotor and the chamber wall. Just as the addition of cylinders increases the horsepower of a piston-powered engine, so the addition of combustion chambers increases the power of a rotary engine. Larger cars may eventually use rotaries with three or four rotors.

3 

Application：Watch the video and name each engine type. Spell and wright each engine type and try to explain each characteristics in a few words.


Click on the icon to play the animation.

4  **Click on the icon to start the application and you must solve the crossword, using words from the reading above.**

5  **Visit the ICE lab and spread in pairs in order to use the service manuals and info databases given, to help you find what kind of engines exists at the lab. You must use a local digital database (Autodata, Tolerence, Vivid etc) or/and internet services to fulfill the engine's identity page!**

 **Click on the icon to watch a relative video, in order to understand what to do!**

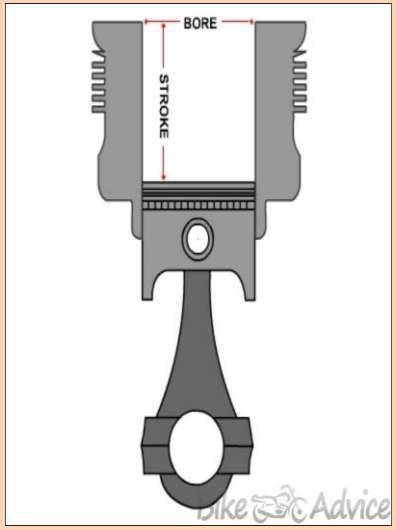
6  **Home work!**

Test yourself! Click on the icon to match the pictures with the right engine types, you can check your answers and try for the perfect score as many times is needed!

Read the article attached on the link below and describe with less than 100 words its meaning. Click on the icon to reach the article.

Timeline: Your text must be delivered in the next lesson.

Next lesson: Stroke



- Reciprocating motion, used in reciprocating engines and other mechanisms, is back-and-forth motion. Each cycle of reciprocation consists of two opposite motions: there is a motion in one direction, and then a motion back in the opposite direction. Each of these is called a stroke. The term is also used to mean the length of the stroke.

In a steam locomotive, Otto or Diesel piston engine, a stroke is the action of a piston travelling the full length of its cylinder in one direction. The stroke length is determined by the cranks on the crankshaft. Stroke can also refer to the distance the piston travels. Click on the picture to watch the animation!