



Script scenario P4S26Y2: Internal *combustion engines*.

The entire scenario is divided into three parts. CEI: Combustion engines. Introduction. Combustion engines classification (P4S20Y2). ECE: External combustion engines (P4S21Y2). ICE: Internal combustion engines (P4S26Y3). The entire scenario could be extended with the topic: Transports and society.

The scenario P4S26Y2 will need 5 hours. Teacher could adapt the activities (order and number) according to the deeper study of the scenario. Some activities could be done and not others (for example, I propose to do at home some activities, it is optional). The same for the activities proposed to do at home (some of them scale-up activities). Activities can be done in groups (pairs ) or individual . Teacher could propose the way of work. In case teacher wants to follow the entire scenario, the activities proposed for each session will be the below:

1st teaching period

1st Activity:

Activity number: -

Time: 7'

Type of activity: Speaking activity. Introducing the scenario.

Class organisation: The entire group.

Actions/Tasks: Teacher introduces the topic. Discuss about the topic. Solving doubts. Teacher could relate this scenario with the scenario CEI (P4S20Y2): "Combustion engines. Introduction. Combustion engines classification", and ECE (P4S21Y2): "Combustion engines. External combustion engines"

2nd Activity:

Activity number: - "Previous activity"

Time: 5'

Type of activity: Multiple choice activity.

Class organisation: Individually.

Actions/Tasks: Students have to answer the proposed questions and self-assess their previous knowledge related to internal combustion engines.

3rd Activity:

Activity number: -

Time: 8'

Type of activity: Speaking/reading activity

Class organisation: The entire group.

Actions/Tasks: Teacher explain the text "**Internal combustion engine**" (Alternatively: students can read the text). Possible discussion about the text. Solving doubts.

4th Activity:

Activity number: -

Time: 5'

Type of activity: Speaking/reading activity.

Class organisation: The entire group.

Actions/Tasks: Teacher explain the text "**Europe and the internal combustion engines**" (Alternatively: students can read the text). Possible discussion about the text. Solving doubts.

5th Activity:

Activity number: -

Time: 10'

Type of activity: Speaking/reading activity.

Class organisation: The entire group.

Actions/Tasks: Teacher explain the text "**The engine in piston engines**" (Alternatively: students can read the text). Possible discussion about the text. Solving doubts.

6th Activity:

Activity number: Activity 1 "**What do you know about piston engines?**"

Time: 10'.

Type of activity: Writing/Calculating activities.

Class organisation: In pairs (optional individually).

Actions/Tasks: Teacher should explain the activity. Students have to answer the proposed questions. Some grammar help is done in the activity.

7th Activity:

Activity number: -

Time: 5'.

Type of activity: Speaking/reading activity.

Class organisation: The entire group.

Actions/Tasks: Teacher explain the text "**The engine cylinder volume**" (Alternatively: students can read the text). Possible discussion about the text. Solving doubts.

8th Activity:

Activity number: Activity 2: "**Let's go to calculate an engine cylinder volume**"

Time: 10'. Activity could be finished at home.

Type of activity: Calculating activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to calculate the unitary and the total cylinder volume of two different cars (following the example done in the previous activity). Teacher should help students solving doubts.

2nd teaching period

1st Activity:

Activity number: -

Time: 10'

Type of activity: Speaking activity. Solving doubts and activity review.

Class organisation: The entire group.

Actions/Tasks: Teacher solve doubts related to the previous day and about the activity 2.

2nd Activity:

Activity number:

Time: 5'

Type of activity: Speaking/reading activity.

Class organisation: The entire group.

Actions/Tasks: Teacher explain the text "***Mechanism to put the combustible and air into the engine cylinder***" (Alternatively: students can read the text). Possible discussion about the text. Solving doubts.

3rd Activity:

Activity number: Activity 3: "**True or false**"

Time: 3'

Type of activity: True/false activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to decide if the proposed sentences are true or false.

4th Activity:

Activity number: Activity 4: "**More information about piston engines. Experts Jigsaw activity**"

Time: 35'

Type of activity: Jigsaw activity.

Class organisation: In groups of three.

Actions/Tasks: Teacher explain the Jigsaw activity. Teacher will make groups of three (this will be the main group) and assign one letter A, B or C to each student. Students have to decide the leader of the group that will be the student that will write down the correct answers to the proposed questions. After that, teacher gives a piece of paper with letters A, B or C to each student of the group. In paper A, student has information related to 4-strokes petrol engines, student B to 2-strokes engines and student C to diesel engines. Students have to read their information (Can't show the information to the partners), and take some notes. Each student will be an expert in the proposed internal combustion engines. In the pieces of paper, students have some link addresses (simulations, diagrams, etc.) that can be consulted. After 15 minutes (approx.) teacher should take the paper sheet given to students, and they can start answering the proposed questions.

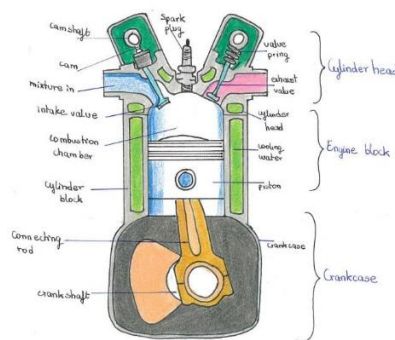
TEXTS ACTIVITY 4

STUDENT A

You have to understand how a petrol four-stroke works in order to explain it to the members of your original team. Discuss it with the members of your Student A team. You have to memorize the parts of the petrol four-stroke engine, the name of each stroke, and what happens in each stroke. You can take some notes about the aspects proposed before, underline the key words, or/and drawing some pictures.

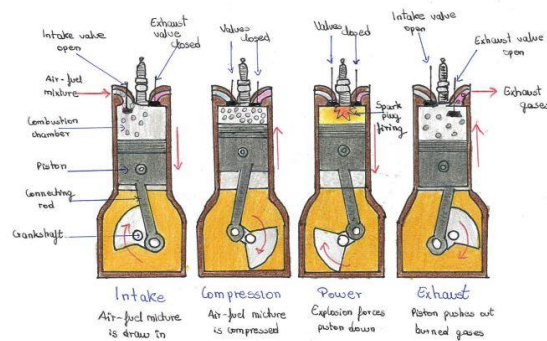
Petrol four-stroke engine

Four-stroke engines were designed by the German engineer Nikolaus Otto (1876). Follow the thermodynamic cycle with his name. A four-stroke engine completes the thermodynamic cycle in four movements of the piston (between the moment in which petrol comes inside the cylinder and it is repeated this action, piston has four movements); for this reason, it is called a four-stroke engine. Use petrol as a combustible (to initiate the combustion process it is needed an air-fuel mixture). With a crankshaft and connecting rod system, the linear movement is transformed into rotary motion. These engines are lighter than Diesel engines.



Four-strokes: (You have the help of a draw)

1. **INTAKE STROKE:** Piston goes down, sucking a mixture of air and fuel into cylinder through the intake port. The intake valve then closes.
2. **COMPRESSION STROKE:** With both intake and exhaust valves closed, piston goes up, compressing fuel and air mixture. This heats mixture.
3. **POWER STROKE:** Spark from spark plug ignites mixture. Gases expand and force piston down.
4. **EXHAUST STROKES:** Piston rises again while the exhaust valve is open, pushing out remains of burned gases as exhaust fumes.



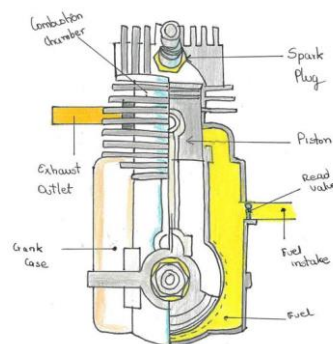
Go to this webpage to watch a simulation: <http://auto.howstuffworks.com/engine1.htm> or <http://www.myrc toys.com/faqs/engine-diagrams-and-animations> (in this last page you have to go to A 4 -Cycle engine and click on a picture) and <http://www.animatedengines.com> (search for your internal combustion engine).

STUDENT B

You have to understand how a two-stroke works in order to explain it to the members of your original team. Discuss it with the members of your Student B team. You have to memorize the parts of the two-stroke engine, the name of each stroke, and what happens in each stroke. You can take some notes about the aspects proposed before, underlined the key words, or/and drawing some pictures.

Two-stroke engine

Invention of the two-stroke cycle is attributed to Scottish engineer Dugald Clerk who invented the 2-stroke engine in 1878 and in 1881 patented his design. The two-stroke engines follow the Otto thermodynamic cycle as well, but this engine complete the cycle in two movements of the piston; for this reason, is called two-stroke engine. This is accomplished by using the beginning of the compression stroke and the end of the combustion stroke to perform simultaneously the intake and exhaust functions. Two-stroke engines require a specific oil to gas ratio. It is used in some motorbikes.



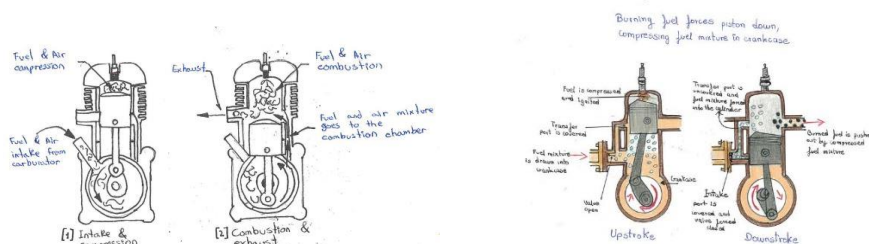
Two-strokes: (You have the help of a draw)

1. INTAKE AND COMPRESSION:

Piston starts its movement from the bottom of the cylinder starting to go-up. The intake port is uncovered and the mixture of combustible and air is pushed to the crankcase where is pressurized by the piston movement. In its up movement, piston covered the exhaust port. When fuel and air in the cylinder have been compressed the spark plug fires the mixture ignites.

2. COMBUSTION AND EXHAUST:

The resulting explosion drives the piston downward. As the piston approaches the bottom of its stroke, the exhaust port is uncovered. The pressure in the cylinder drives most the exhaust gases out of cylinder. Note that as the piston moves downward, it is compressing the air/fuel mixture in the crankcase.



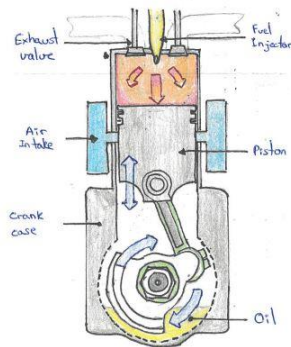
Go to this webpage to watch a simulation: <http://science.howstuffworks.com/transport/engines-equipment/two-stroke2.htm> or <http://www.myrctoys.com/faqs/engine-diagrams-and-animations> (in this last page you have to go to A 2 -Cycle engine and click on a picture) and <http://www.animatedengines.com> (search for your internal combustion engine).

STUDENT C

You have to understand how a diesel four-stroke works in order to explain it to the members of your original team. Discuss it with the members of your Student C team. You have to memorize the parts of the diesel four-stroke engine, the name of each stroke, and what happens in each stroke. You can take some notes about the aspects proposed before, underlined the key words, or/and drawing some pictures.

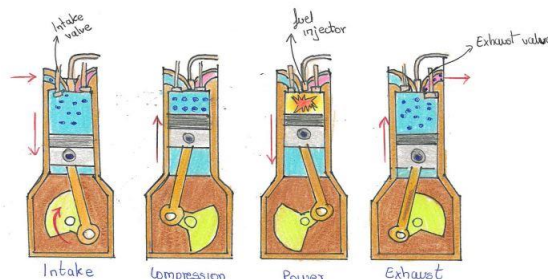
Diesel four-stroke engine

Diesel engine was designed by the German engineer Rudolf Diesel in 1897. Follow the thermodynamic cycle with his name (Diesel). Diesel engine is used mainly by larger vehicles and some trains, and in the last years is becoming more popular in private cars in Europe. Diesel engines work in a similar way to petrol engines, but at stroke one, only air is taken into the cylinder. This is compressed and heated to a very high temperature at stroke two. Diesel fuel is forced into the cylinder at stroke three, where it is so hot that the fuel burns without a spark. So, this kind of engines doesn't need spark plug. Diesel engines can be used for much more time than the petrol engines. Diesel engines have the highest thermal efficiency of any regular internal or external engine; the fuel is Gasoil. Diesel engines are noisier than petrol engines.



Four-strokes: (You have the help of a draw)

1. **INTAKE STROKE:** Piston goes down, sucking air into cylinder through the intake port. The intake valve then closes.
2. **COMPRESSION STROKE:** With both intake and exhaust valves closed, piston goes up, compressing the air. This heats the air.
3. **POWER STROKE:** As the piston reaches the top, fuel is injected at just the right moment and ignited with the hot air. Gases expand and force piston down.
4. **EXHAUST STROKES:** Piston rises again while the exhaust valve is open, pushing out remains of burned gases as exhaust fumes.



Go to any of these webpage to watch a simulation: <http://auto.howstuffworks.com/diesel1.htm> or <http://www.myrctoys.com/faqs/engine-diagrams-and-animations> (in this last page you have to go to Diesel engine and click on a picture) and <http://www.animatedengines.com> (search for your internal combustion engine).

5th Activity:

Activity number: Activity 5: **“Compare the three piston engines studied”**

Time: 7’

Type of activity: Writing activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Teacher explain the activity 5. Students have to write a composition comparing the three different piston engines. Students should do the activity at home. Students have some web pages, some grammar help and a comparative text like example, to help them to write the composition.

3rd teaching period

1st Activity:

Activity number: -

Time: 5’

Type of activity: Speaking activity. Solving doubts and activity review.

Class organisation: The entire group.

Actions/Tasks: Teacher solve doubts related to the previous day and about the activity 5.

2nd Activity:

Activity number: -

Time: 10’

Type of activity: Speaking/reading activity.

Class organisation: The entire group.

Actions/Tasks: Teacher explain the text **“New combustion engines”** (Alternatively: students can read the text). Possible discussion about the text. Solving doubts.

3rd Activity:

Activity number: Activity 6: **“To know more about the new combustion engines”**

Time: 10’

Type of activity: Writing activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to write a composition comparing HEV and PHEV engines. Some grammar help is done. If the activity is not finished, students can finish it at home.

4th Activity:

Activity number: Activity 7: **“To know more about new combustion engines”**

Time: 10'

Type of activity: Writing activity

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to search for some information (on the net) about hydrogen engines and they have to write a composition about them. Some grammar help is done. If the activity is not finished, students can finish it at home.

5th Activity:

Activity number: Activity 8: "**Components of a car**"

Time: 13'

Type of activity: Reading/speaking/matching activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to read the definitions related to some components of a car. Each definition has a number (29 definitions). Students have a picture and a car drawn (with some letters (18 letters). Students have to match the number (according to the definition) with the letter of the car drawn. After that, they have to write the number of the 11 definitions that doesn't appear in the car drawn.

6th Activity:

Activity number: Activity 9: "**Name of the main components in a car**"

Time: 7'

Type of activity: Reading/speaking/watching activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to find the name of the 29 definitions (they have a help to find the names, by introducing the start letter of the component). They have to match the picture with its correct name.

7th Activity:

Activity number: Activity 10: "**Car's catalogue wiki**"

Time: 5'.

Type of activity: Creating a Wiki activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Teacher should explain the activity. Students have to build a wiki in which they write the main characteristics of different European cars (they have to search for some information on the net or in a car shop). Some help (an example) is given. Activity should be done at home.

4th teaching period

1st Activity:

Activity number: -

Time: 5'

Type of activity: Speaking activity. Solving doubts and activities review.

Class organisation: The entire group.

Actions/Tasks: Teacher solve doubts related to the previous day and about the activity 10. Students could share the obtained information.

2nd Activity:

Activity number: Activity 11: **“How many European car’s manufacturing companies do you know?”**

Time: 5'

Type of activity: Writing activity

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to write the name of ten European car manufacturing companies. Each correct answer 1 point.

3rd Activity:

Activity number: Activity 12: **“Match the car’s components pictures with the correct definition”**

Time: 10'

Type of activity: Matching activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to match the pictures about components of a car with their definitions.

4th Activity:

Activity number: Activity 13: **“Match car’s components pictures and its names”**

Time: 10'

Type of activity: Cards matching/remembering activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to match pictures with its correct name, by matching both cards (picture and name).

5th Activity:

Activity number: Activity 14: **“Write the name of the car’s components that you identify in next pictures”**

Time: 5'

Type of activity: Identifying and writing activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to identify the components of a car (3 car pictures) and write them.

6th Activity:

Activity number: -

Time: 5'

Type of activity: Speaking/reading activity.

Class organisation: The entire group.

Actions/Tasks: Teacher explain the text "**The engine in rotary engines**" (Alternatively: students can read the text). Possible discussion about the text. Solving doubts.

7th Activity:

Activity number: Activity 15: "**Simulations to know more about rotary engines**"

Time: 5'.

Type of activity: Searching for some information activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to search for some information (on the proposed web page (simulations)) about how a Wankel engine works. This information could be used in next activities.

8th Activity:

Activity number: Activity 16: "**The Wankel engine**"

Time: 5'.

Type of activity: Putting in order a text.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to put in order a text.

9th Activity:

Activity number: Activity 17: "**The Wankel engine**"

Time: 5'.

Type of activity: Matching activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to match pictures with the correct stroke of a Wankel engine.

10th Activity:

Activity number: Activity 18: "**The Wankel engine**"

Time: 5'.

Type of activity: Writing activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students write a composition describing how a Wankel engine works. They have some grammar help and they can use the web pages done in previous activities. Students should finish the activity at home.

5th teaching period

1st Activity:

Activity number: -

Time: 5'

Type of activity: Speaking activity. Solving doubts and activities review.

Class organisation: The entire group.

Actions/Tasks: Teacher solve doubts related to the previous day and about the activity 18.

2nd Activity:

Activity number: Activity 19: "**Gas turbines and Jet engines**"

Time: 5'

Type of activity: Filling the gaps activity

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to fill in the gas with the correct word.

3rd Activity:

Activity number: Activity 20: "**Taboo or Pictionary games**"

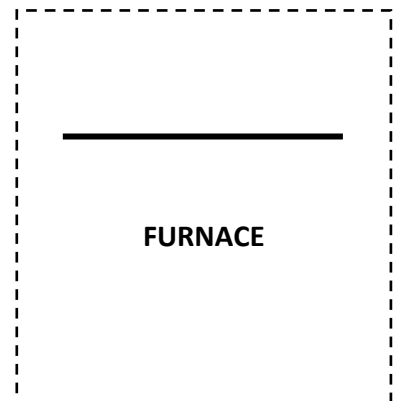
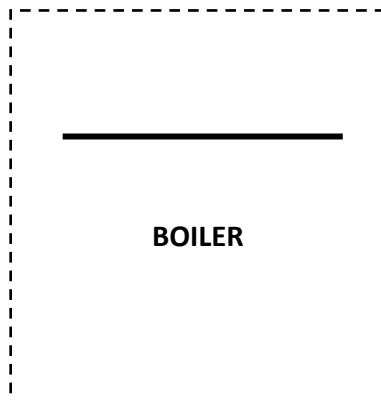
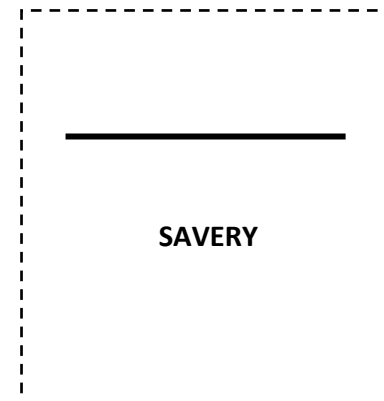
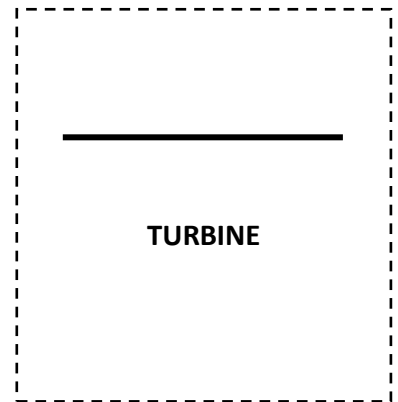
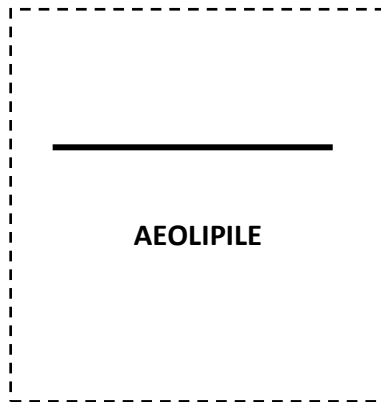
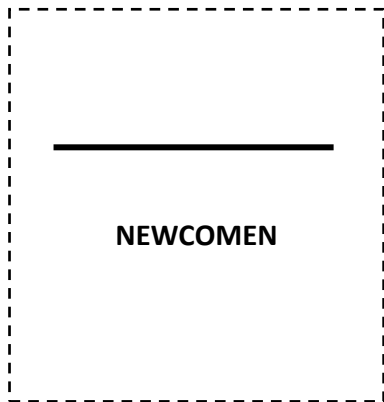
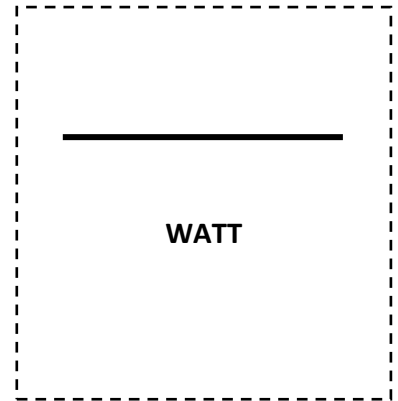
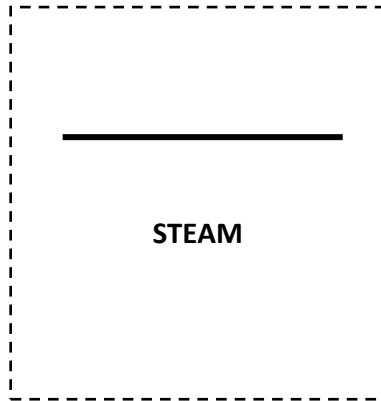
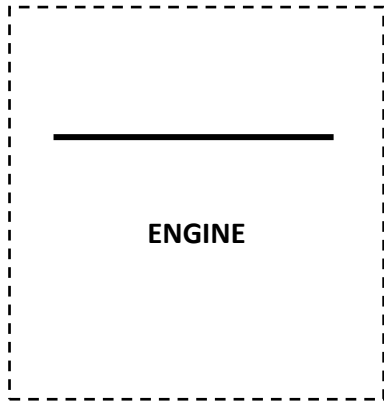
Time: 20'

Type of activity: Taboo/Pictionary activity.

Class organisation: In pairs (optional in bigger groups).

Actions/Tasks: One student has to define (or draw) the word that appear in the card and the other (or others) student has to guess the word.

TABOO-PICTIONARY CARDS



COAL

COMBUSTION

CYLINDER

PISTON

FLYWHEEL

EXHAUST VALVE

SEAT BELT

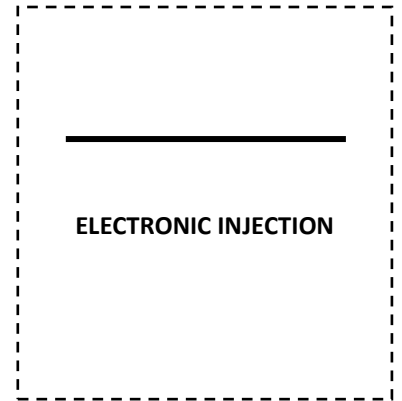
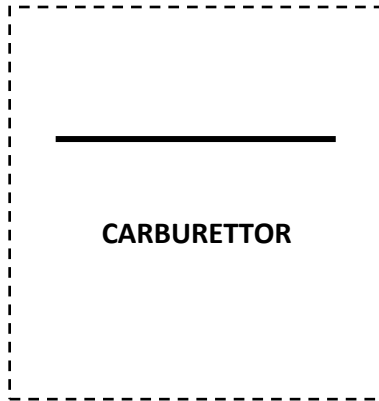
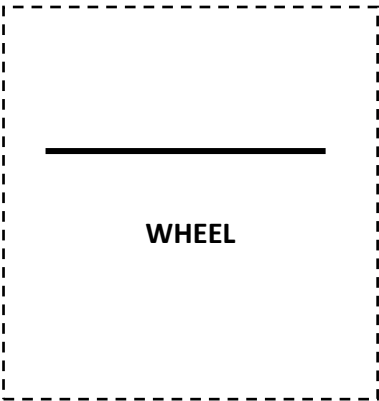
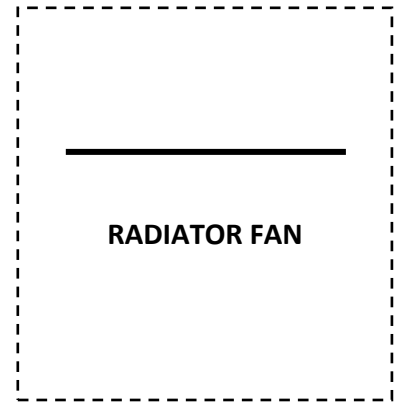
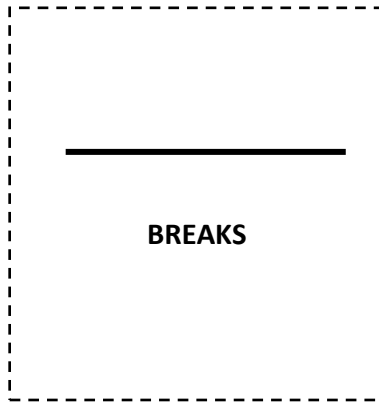
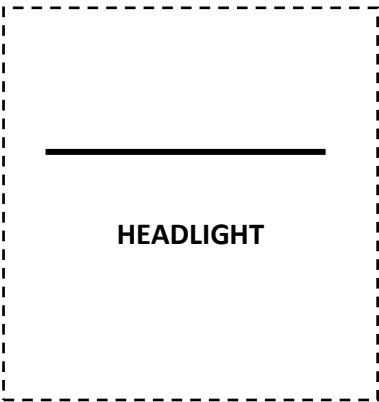
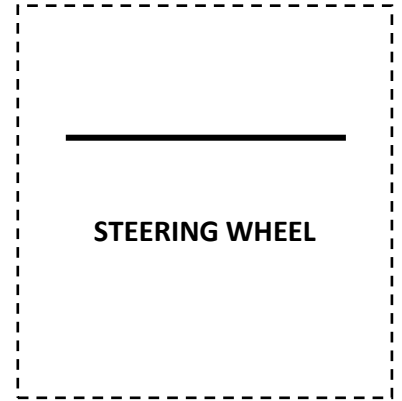
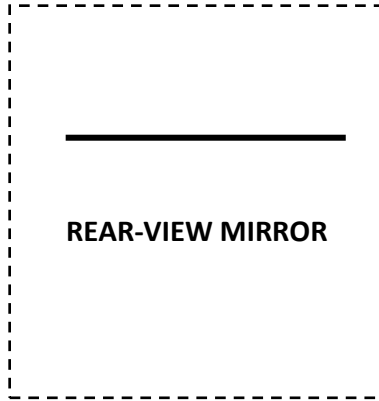
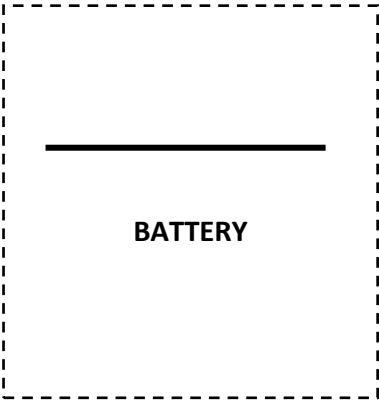
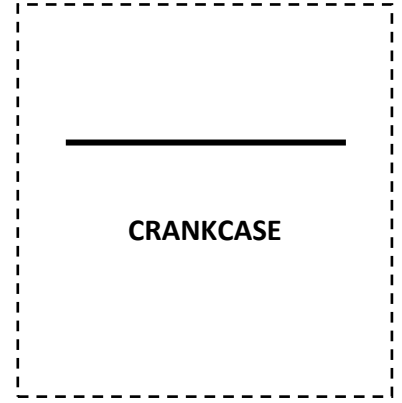
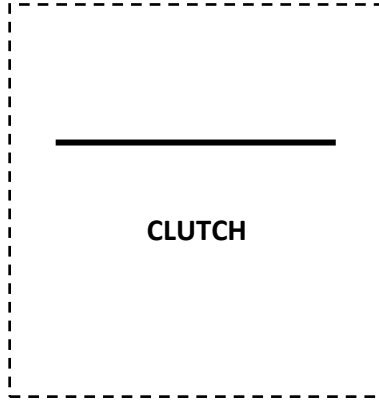
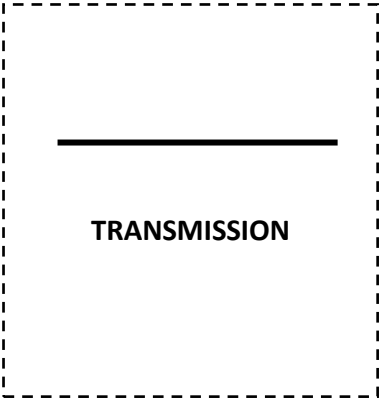
PRESSURE

ROTOR

STATOR

SUSPENSION

GEAR LEVER



TURBO COMPRESSOR

SPARK PLUG

CYLINDER HEAD

ENGINE BLOCK

CYLINDERS IN V

BORE

STROKE

ENGYNE CYLINDER VOLUME

FOUR-STROKE ENGINE

TWO-STROKE ENGINE

GASES

FUEL

EXHAUST STROKE

POWER STROKE

COMPRESSION STROKE

INTAKE STROKE

GASOIL

INTAKE PORT

CRANKSHAFT

CONNECTING ROD

WANKEL ENGINE

JET ENGINE

DIESEL ENGINE

PETROL ENGINE

CARBON DIOXIDE

HEAT

SULPHUR OXIDES

CARBON MONOXIDE

GLOBAL WARMING

ACID RAIN

GREENHOUSE EFFECT

CHEMICAL FOG

NITROGEN OXIDES

CAR DASHBOARD

WINDSCREEN

CAR BUMPER

WIPER WASHER

CARDAN

ROCKET ENGINE

CAMSHAFT

STEERING

GAS TURBINE

4th Activity:

Activity number: Activity 21: “**Combustion engines’ crosswords**”

Time: 15’

Type of activity: Crossword’s activity.

Class organisation: In pairs (optional individually).

Actions/Tasks: Students have to find the crossword’s words solving the definitions.

5th Activity:

Activity number: -

Time: 10’

Type of activity: Speaking activity

Class organisation: The entire group.

Actions/Tasks: Teacher should summarize the scenario, solving doubts.

6th Activity:

Activity number: -

Time: 5’

Type of activity: Self-assessment activity.

Class organisation: Individual activity.

Actions/Tasks: Teacher explain the self-assessment activity. Students could finish the activity at home.

Suggestions for future development and expansion of the scenario

Prepare a new scenario about “transports and society”.