

# Internal Combustion Engine

Follow the instructions attached to construct this model. It is based on a cyclical tetraflexagon. Every time you flip a layer (fold inwards) describes a different stroke. The complete cycle is four strokes and two complet rotations of the crankshaft.

## Part 1

A A

### 1. INTAKE

The piston is descending.  
The intake valve is open.  
The resulting vacuum pressure draws the fuel/air mixture into the cylinder

E

**3. COMBUSTION**  
This is the power stroke. In the illustration, the piston has just passed the point referred to as Top Dead Centre (TDC). This is the highest position of the piston and it is where the fuel mixture is ignited. This mini explosion creates a huge force which pushes the piston down.

## Part 2

**Four Stroke Engine**  
This model shows the basic operation of a four stroke internal combustion engine. Note that the crankshaft completes two full rotations over the course of these four strokes.

fuel/air mixture in

## Material

The model should be printed on paper (80-120gsm), as it will be doubled up during construction.

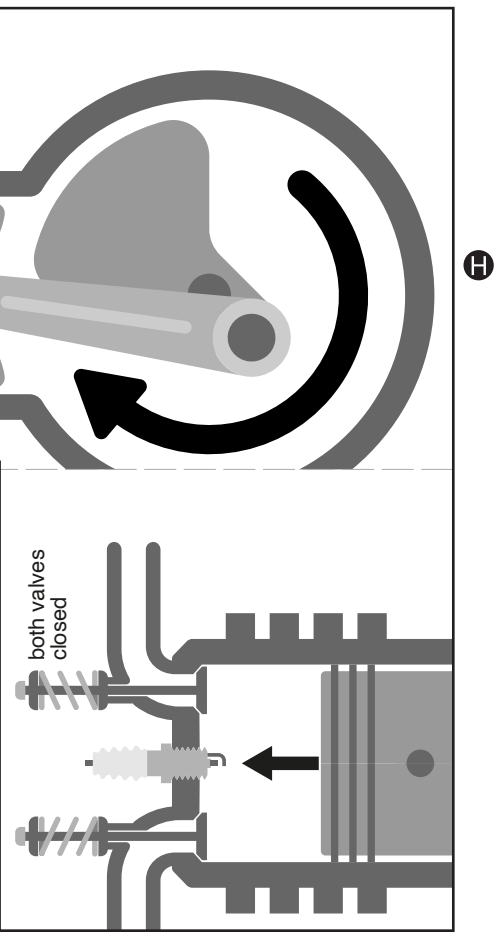
F

### Spark Plug

The spark plug is what ignites the fuel and air mixture. Between 10,000-20,000 volts are generated between the electrode surfaces to create the spark. The ceramic part of the spark plug that you can see outside the engine is to insulate the device from surrounding surfaces. The temperature in the combustion chamber at this point can reach 1500-2000°C, the pressure 50 or more Bar.

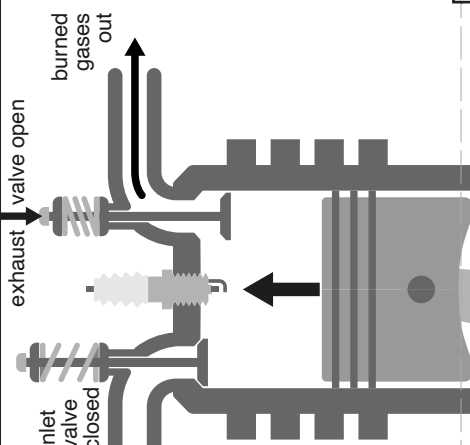
A A

## Part 4



C

both valves  
closed



H

inlet  
valve  
closed

exhaust  
valve  
open

burnt  
gases  
out

### Engine Capacity

The size of an engine is determined by the volume displaced by the movement of the piston. It can be calculated by multiplying the bore (surface area of piston) by the stroke (distanced travelled). It is normally measured in Cubic Centimetres, or "CC." The higher the CC, the more power the engine has, but also the more fuel it will use.

## 2. COMPRESSION

After sucking the fuel mixture into the cylinder, both valves close and piston ascends to compress the gases.

B

B

G

B

B

### End of Cycle

The exhaust stroke is the final part of the four strokes. To continue to, turn the model upside down, fold the top and bottom of the model together and pull apart from behind. The cycle will start again with the intake stroke.

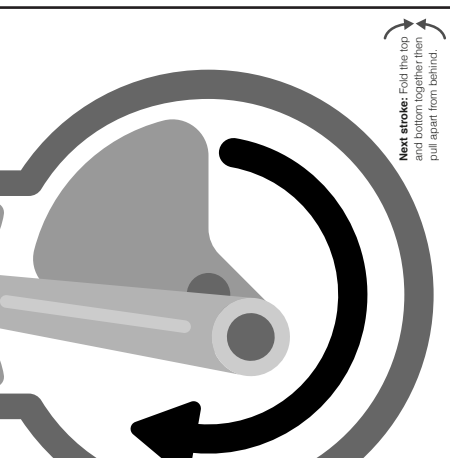


## 4. EXHAUST

The piston is ascending from Bottom Dead Centre (BDC) to TDC. During this stroke the exhaust valve is open. The burnt gases resulting from combustion are pushed out of the cylinder into the exhaust system.

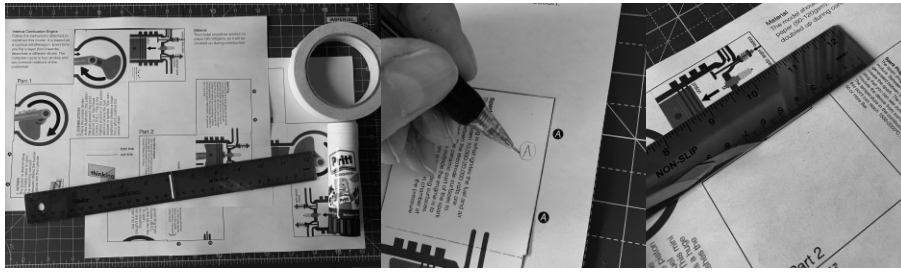
Next stroke: fold the top and bottom together then pull apart from behind.

## Part 3



G

①



① You will need: printed paper, masking tape, glue, pencil.

First Transfer the reference marks onto the print using the pencil (you need these to construct the model, but you can erase at the end). Cut out all parts along black line.

② Use low-tack tape to join Parts 1 and 2 where labelled **A** and Parts 3 and 4 where labelled **B**

③ Lay the two parts back-to-back as shown so that only squares **C** and **D** are left single-sided.

④ Glue the two sides together, leaving squares **C** and **D** unglued.

⑤ Use a folding tool (if you have one) to fold along thin dotted lines.

⑥ Remove the tape applied in step ②

⑦ Fold the model in the following sequence: **E** to **E**; **F** to **F**; **G** to **G**; **H** to **H**.

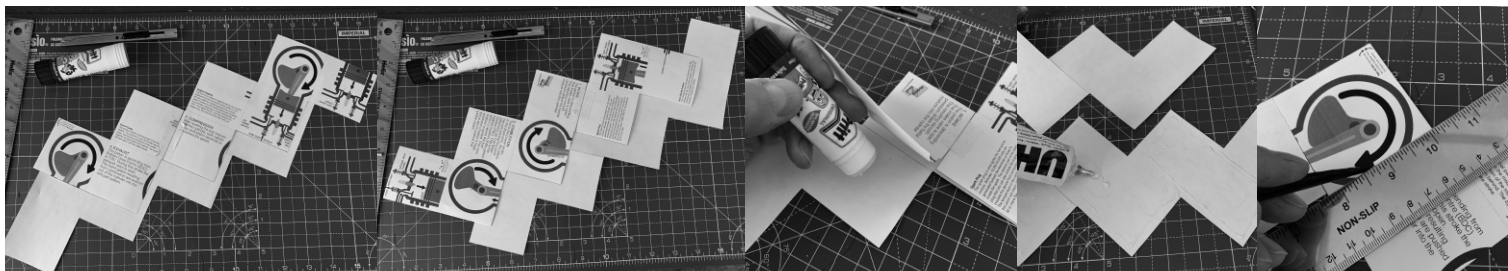
⑧ Glue the squares **C** and **D** together.

⑨ Erase the pencil marks that you made in step ①.

②



③



④

⑤

⑥

⑦



⑧

⑨



Design: Ben Hughes.

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