

3 A cycle of changes in pressure, volume and temperature of gas inside a cylinder of a petrol engine with a movable piston is illustrated in Fig. 3.1. The gas is assumed to be ideal.

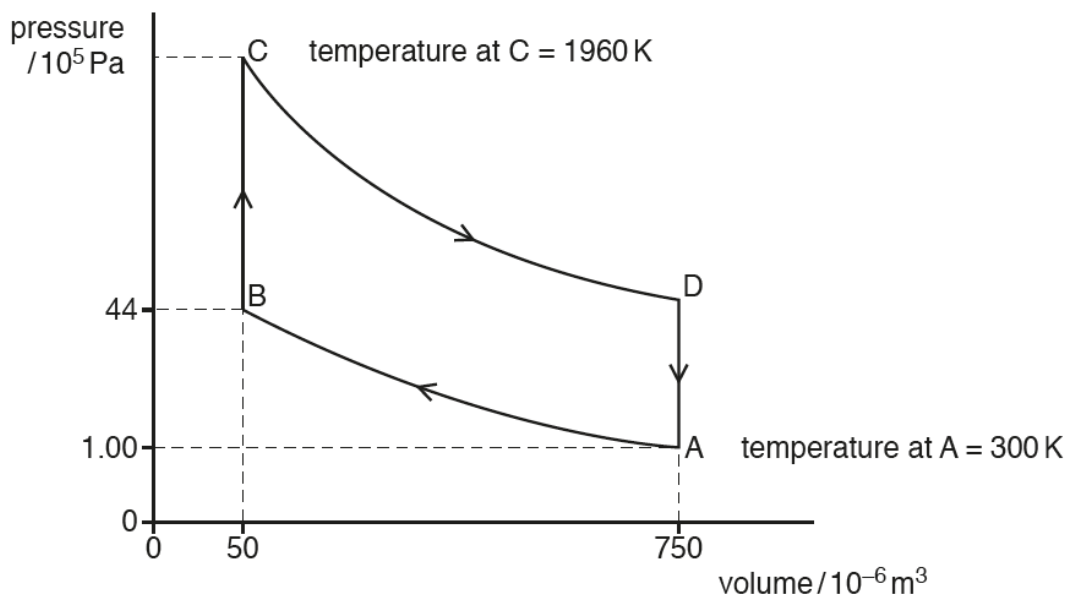


Fig. 3.1 (not to scale)

There are four stages in the cycle.

stage	description
A to B	Rapid compression of the gaseous petrol/air mixture with the temperature rising from 300 K at A and the pressure rising to 44×10^5 Pa at B.
B to C	The petrol/air mixture is exploded, resulting in an almost instant rise in pressure. At C the temperature has risen to 1960 K.
C to D	Rapid expansion and cooling of the hot gases.
D to A	Return to the starting point of the cycle.

- (a) (i) State what is meant by an *ideal gas*.

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 [1]

- (ii) Use the values in Fig. 3.1 to determine the number of moles present in the gases in the cycle.

number of moles = moles [2]

- (b) Complete the table in Fig. 3.2 showing the work done on the gas, the heat supplied to the gas and the increase in the internal energy of the gas, during the four stages of one cycle.

stage	work done on gas / J	heat supplied to gas / J	increase in internal energy of gas / J
A to B	+ 360	0	
B to C		+ 670	
C to D		0	– 810
D to A			

Fig. 3.2

[4]

- (c) Explain qualitatively how molecular movement causes the fall in temperature of the gas during the stage from C to D.

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 [2]

- (d) Explain using Fig. 3.2 why the engine can be used in cars.

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 [1]