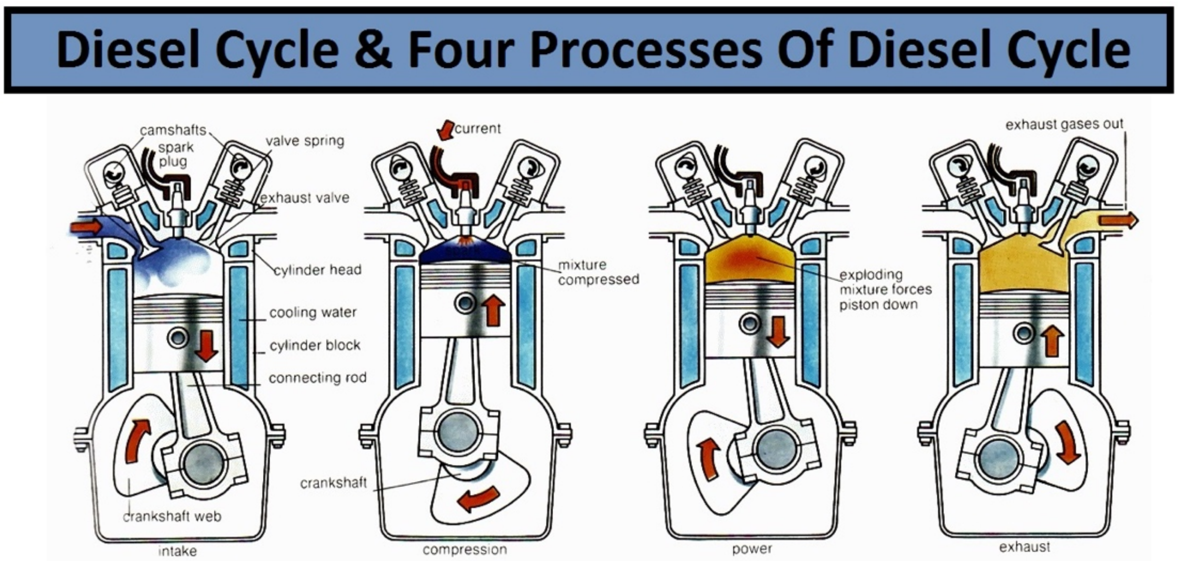

Image: https://engineeringinsider.org/diesel-cycle-four-processes/

ME 200 (Thermodynamics I)
Lecture 30
Isentropic Processes

Recall from Lecture 25:

For an incompressible substance:

$$s(T_2) - s(T_1) = \int_{T_1}^{T_2} c(T)\frac{dT}{T}$$

For an ideal gas:

$$s_2(T_2, p_2) - s_1(T_1, p_1) = s^0(T_2) - s^0(T_1) - R\ln\left(\frac{p_2}{p_1}\right)$$

For an ideal gas undergoing an isentropic process:

$$\frac{p_2}{p_1} = \frac{p_r(T_2)}{p_r(T_1)}$$

$$\frac{v_2}{v_1} = \frac{v_r(T_2)}{v_r(T_1)}$$

Temp. [K]	h [kJ/kg]	u [kJ/kg]	s° [kJ/kg/K]	p_r	v_r
200	200.0	142.5	1.309	0.3363	1707.0
210	210.0	149.7	1.352	0.3987	1512.0
220	220.0	156.8	1.395	0.4690	1346.0
230	230.0	164.0	1.437	0.5477	1205.0
240	240.0	171.1	1.479	0.6355	1084.0
250	250.0	178.3	1.520	0.7329	979.0
260	260.0	185.4	1.559	0.8405	887.8
270	270.0	192.6	1.597	0.9590	808.0
280	280.1	199.8	1.633	1.0889	738.0
285	285.1	203.3	1.651	1.1584	706.1
290	290.1	206.9	1.669	1.2311	676.1

For a perfect gas undergoing an isentropic process:

$$\frac{v_2}{v_1} = \left(\frac{T_2}{T_1}\right)^{\frac{1}{1-k}}$$

$$\frac{p_2}{p_1} = \left(\frac{T_2}{T_1}\right)^{\frac{k}{k-1}}$$

$$\frac{p_2}{p_1} = \left(\frac{v_2}{v_1}\right)^{-k}$$