3 The volume of some air, assumed to be an ideal gas, in the cylinder of a car engine is $540\,cm^3$ at a pressure of $1.1 \times 10^5\,Pa$ and a temperature of 27 °C. The air is suddenly compressed, so that no thermal energy enters or leaves the gas, to a volume of $30\,cm^3$. The pressure rises to $6.5 \times 10^6\,Pa$.

(a) Determine the temperature of the gas after the compression.

temperature = ... K [3]

(b) (i) State and explain the first law of thermodynamics.

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..... [2]

(ii) Use the law to explain why the temperature of the air changed during the compression.

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.....[4]