<table>
<tr><td rowspan="2">4(a)(i)</td><td>sum of potential energy and kinetic energy</td></tr>
<tr><td>(total) energy of random motion of particles</td></tr>
<tr><td rowspan="2">4(a)(ii)</td><td>potential energy (of molecules) (in an ideal gas) is zero, so the internal energy of the gas is equal to the total kinetic energy (of molecules)</td></tr>
<tr><td>kinetic energy of molecules is proportional to (thermodynamic) temperature (so internal energy is proportional to (thermodynamic) temperature))</td></tr>
<tr><td rowspan="4">4(b)</td><td>cooling work done = 0</td></tr>
<tr><td>compression increase in internal energy = +2U</td></tr>
<tr><td>cooling change in internal energy = –U</td></tr>
<tr><td>both rows: thermal energy adds to work to give increase in internal energy in terms of U and/or W

(if fully correct, thermal energy for compression = 2U – W and thermal energy for cooling = –U:
<table>
<tr><td>compression</td><td>+W</td><td>2U – W</td><td>+2U</td></tr>
<tr><td>cooling</td><td>0</td><td>–U</td><td>–U</td></tr>
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)</td></tr>
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