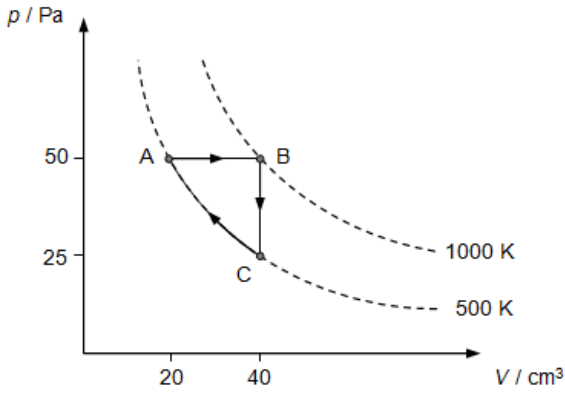


## Thermal Physics Revision Checklist (2020)

Sub-topics	Key concepts/ questions	Tick																		
Definitions	<p>Thermal Equilibrium, Absolute Zero, Triple Point of Water, Thermodynamic scale vs Empirical scale,</p> <p>Heat Capacity, Specific Heat Capacity, Specific Latent Heat of Fusion, Specific Latent Heat of Vaporisation,</p> <p>mole, Avogadro number (<math>N_A = 6.02 \times 10^{23} \text{ mol}^{-1}</math>), Ideal gas</p> <p>Internal energy, First Law of Thermodynamics</p>																			
Formulae	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Conversion:</td> <td style="padding: 5px;"><math>T/K = T/^{\circ}\text{C} + 273.15</math></td> </tr> <tr> <td style="padding: 5px;"><i>Heat capacity C:</i></td> <td style="padding: 5px;"><math>Q = C \Delta\theta</math></td> </tr> <tr> <td style="padding: 5px;"><i>Specific heat capacity c:</i></td> <td style="padding: 5px;"><math>Q = m c \Delta\theta</math></td> </tr> <tr> <td style="padding: 5px;"><i>Specific latent heat l:</i></td> <td style="padding: 5px;"><math>Q = m l</math></td> </tr> <tr> <td style="padding: 5px;"><i>Expressions considering heat/power lost to surroundings</i></td> <td style="padding: 5px;"><math>Q = m c \Delta\theta + h_{\text{loss}}</math> <math>P = m c \Delta\theta / t + P_{\text{loss}}</math></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Ideal Gas Equations:</td> <td style="padding: 5px;"><math>pV = nRT</math> <math>pV = NkT</math></td> </tr> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 5px;">First Law of Thermodynamics</td> <td style="padding: 5px;"><math>\Delta U = q + w</math></td> </tr> <tr> <td style="padding: 5px;">Work done by system at constant pressure</td> <td style="padding: 5px;"><math>w_{\text{by}} = p\Delta V</math></td> </tr> <tr> <td style="padding: 5px;">Work done on system at constant pressure</td> <td style="padding: 5px;"><math>w_{\text{on}} = -p\Delta V</math></td> </tr> </table>	Conversion:	$T/K = T/^{\circ}\text{C} + 273.15$	<i>Heat capacity C:</i>	$Q = C \Delta\theta$	<i>Specific heat capacity c:</i>	$Q = m c \Delta\theta$	<i>Specific latent heat l:</i>	$Q = m l$	<i>Expressions considering heat/power lost to surroundings</i>	$Q = m c \Delta\theta + h_{\text{loss}}$ $P = m c \Delta\theta / t + P_{\text{loss}}$	Ideal Gas Equations:	$pV = nRT$ $pV = NkT$	First Law of Thermodynamics	$\Delta U = q + w$	Work done by system at constant pressure	$w_{\text{by}} = p\Delta V$	Work done on system at constant pressure	$w_{\text{on}} = -p\Delta V$	
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Simple kinetic model for matter	<ul style="list-style-type: none"> <li>• Explain using simple kinetic model for matter why               <ul style="list-style-type: none"> <li>○ melting and boiling takes place without a change in temperature,</li> <li>○ the specific latent heat of vaporisation is higher than specific latent heat of fusion for the same substance,</li> <li>○ cooling effect accompanies evaporation.</li> </ul> </li> </ul>																			
Kinetic theory of gases	<ul style="list-style-type: none"> <li>• State basic assumptions of the kinetic theory of gases.</li> <li>• Explain how molecular movement causes the pressure exerted by a gas.</li> <li>• Derive relationship <math>pV = \frac{1}{3} Nm\langle c^2 \rangle</math></li> </ul>																			

Kinetic energy of a molecule	<p>Mean KE of <u>a molecule</u> of an ideal gas is <u>proportional to the thermodynamic temperature</u>.</p> $\langle KE \rangle \propto T$ $\langle KE \rangle = \frac{1}{2} m \langle c^2 \rangle = \frac{3}{2} kT$	
Internal Energy	<p>Internal energy is <u>determined by the state of the system</u> and it can be expressed as the <u>sum of random distribution of kinetic and potential energies associated with the molecules of a system</u>.</p> $U = \text{molecular K.E} + \text{molecular P.E}$ <p>For an ideal gas (<i>negligible molecular PE</i>),</p> $U = \text{molecular K.E} = \frac{3}{2} NkT = \frac{3}{2} pV$	
1 <sup>st</sup> Law of Thermodynamics	<p>The first law of thermodynamics states that the <u>internal energy is a function of state</u> and the <u>increase in internal energy is equal to the sum of heat supplied to the system and the work done on the system</u>.</p> $\Delta U = q + w$	
p-V graph	<ul style="list-style-type: none"> <li>Represent thermodynamics states (e.g. states A, B, C as illustrated below) and thermodynamic changes (e.g. process A to B) for a fixed mass (fixed no. of moles) of an ideal gas.</li> </ul>  <p>To note:</p> <ul style="list-style-type: none"> <li>Pressure, volume, and temperature values as indicated for a particular thermodynamic state.</li> <li>Isotherms represent lines joining points of the same temperature.</li> <li>Work done = area under <i>p-V</i> graph</li> <li>Special thermodynamic processes: isochoric (<math>\Delta V = 0</math>), isobaric (<math>\Delta p = 0</math>), isothermal (<math>\Delta T = 0</math>), adiabatic (<math>q = 0</math>), cyclic (<math>\Delta U = 0</math>).</li> <li>Apply ideal gas law and first law of thermodynamics.</li> </ul>	