A-Level Physics: **w25 43**

2(a)	work done on / by system
	thermal energy supplied to / removed from system
2(b)(i)	no thermal energy transferred to / from system (due to lack of time)
	work is done on the gas to compress it / to decrease its volume
	internal energy increases so temperature increases
2(b)(ii)	(during vaporisation) molecular separation increases
	(heating causes) potential energy of molecules to increase
	kinetic energy of molecules unchanged so temperature unchanged

A-Level Physics: **w23 41**

2(a)	(thermal) energy per unit mass (to change temperature)
	(thermal) energy per unit change in temperature
2(b)(i)	work done $= p\Delta V$ $= (2.0 \times 10^5) \times (0.063 - 0.038) = 5000$ J
2(b)(ii)	gas is expanding (against external pressure)
	gas does work / work is done by gas, so (work done on gas is) negative
2(b)(iii)	$\Delta U = q + W$
	$7600 = q + (-5000)$ $q = 12\,600$ J
2(b)(iv)	specific heat capacity $= q / m\Delta T$ $= 12600 / (0.35 \times 56)$
	$= 640$ J kg^{-1} K^{-1}
2(c)	same gain in internal energy so same temperature rise
	no change in volume so no work done **or** no work done so less thermal energy needed (for same change in internal energy)
	less thermal energy needed (for same temperature change) so lower specific heat capacity

A-Level Physics: **m23 42**

2(a)	gas for which $pV \propto T$
	where T is thermodynamic temperature
2(b)(i)	evidence of two temperature conversions between °C and K
	two calculations shown, one for each state e.g. $\frac{1.10\times10^5\times540\times10^{-6}}{(273+27)} = 0.198$ **and** $\frac{6.70\times10^6\times30\times10^{-6}}{(273+742)} = 0.198$
2(b)(ii)	work is done on the gas
	internal energy increases (so temperature increases)

2(b)(iii)	$pV = NkT$ e.g. $N = \frac{1.10\times10^{5}\times540\times10^{-6}}{1.38\times10^{-23}\times300}$ $= 1.435 \times 10^{22}$ $\Delta E_k = (3/2)\, k\Delta TN$
	$= (3/2) \times 1.38 \times 10^{23} \times (742 - 27) \times \frac{1.10\times10^{5}\times540\times10^{-6}}{1.38\times10^{-23}\times300}$
	$= 212$ J
2(c)	$E = mc\Delta\theta$ **and** $E = mL$
	$\Delta\theta = (27 + 196)$ or 223
	$E = 0.0240 \times 1.04 \times (27 + 196) + 0.0240 \times 199$ $= 10.3$ kJ