Name of the Student:_____
Max. Marks : 19 Marks **Time : 19 Minutes**

Mark Schemes

Q1.

Question Number	Acceptable answers		Additional guidance	Mark
	• Use of $\Delta Q = mc\Delta\theta$ • … for correct temperature change • Use of $\Delta Q = L\Delta m$ • Use of $P = E/t$ • It is not transferred faster because: 823 (W to water) < 2400 (W to iron) **Or** 46 100 (J to water) < 134 400 (J to iron) **Or** 19.2 (s to evaporate water at rate of 2400 W) < 56 (s taken)	(1) (1) (1) (1) (1)	Example of calculation mass of water = 0.0359 kg – 0.0182 kg = 0.0177 kg ΔQ = 0.0177 kg × 4190 J kg^{-1} K^{-1} × (100 °C – 18 °C) = 6100 J ΔQ = (0.0177 kg) × 2.26 × 10^6 J kg^{-1} = 40 000 J P = (6100 J + 40 000 J) / 56 s = 823 W	5

Q2.

Question Number	Answer	Mark
	Use of $pV = NkT$ (1) Temperature conversion (1) $\Delta N = 5.1 \times 10^{23}$ (1) [allow use of $pV = nRT$ and use of $N = n \times N_A$ for mp1] Example of calculation: $\Delta N = \frac{V\Delta p}{kT} = \frac{0.052\,\text{m}^3 \times (2.0\times10^5 - 1.6\times10^5)\,\text{Pa}}{1.38\times10^{-23}\,\text{J K}^{-1}(273+22)\,\text{K}} = 5.11\times10^{23}$	3
	Total for Question	3

Q3.

Question Number	Answer	Mark
	Use of $E_k = ½mv^2$ (1) Use of 25% (1) Use of $\Delta E = mc\Delta\theta$ (1) $\Delta\theta = 39$ K [accept 39°C] (1) Example of calculation: $E_k = \frac{1}{2}mv^2 = 0.5 \times 1200\,\text{kg} \times (25\,\text{m s}^{-1})^2 = 3.75 \times 10^5\,\text{J}$ $\Delta\theta = \frac{\Delta E}{mc} = \frac{0.25 \times 3.75 \times 10^5\,\text{J}}{5.3\,\text{kg} \times 450\,\text{J kg}^{-1}\,\text{K}^{-1}} = 39.3\text{K}$	4
	Total for Question	**4**

Q4.

Question Number	Acceptable Answer	Additional Guidance	Mark
	• Use of $P = VI$ (1) • Calculation of gradient (1) • Gradient $= \frac{\Delta m}{\Delta t}$ (1) • Use of $\Delta E = mL$ and $P = \frac{\Delta E}{\Delta t}$ (1) (1) • $L = 2.30 \times 10^6$ (J kg^{-1}) • Comparison of calculated value for L with values in table and appropriate conclusion. (1) (1)	For MP2 and MP3 credit Δm read from graph and used with corresponding Δt value For MP3 and MP4, credit $L = \frac{VI}{\text{gradient}}$ Answers in the range $(2.26 - 2.34) \times 10^6$ J kg^{-1}	

	• But not all of the energy supplied to the liquid will be used to boil the liquid **Or** thermal energy will be transferred to surroundings	Example of calculation: grad= $\frac{(211\text{-}155)\times10^{-3}\ \text{kg}}{(0\text{-}600)\ \text{s}} = 9.33\times10^{-5}\ \text{kg s}^{-1}$ $\therefore \frac{\Delta m}{\Delta t} = 9.33\times10^{-5}\ \text{kg s}^{-1}$ $P = 20.5\ \text{V} \times 10.5\ \text{A} = 215\ \text{W}$ $\therefore L = \frac{215\ \text{W}}{9.33\times10^{-5}\ \text{kg s}^{-1}} = 2.30\times10^{6}\ \text{J kg}^{-1}$	7