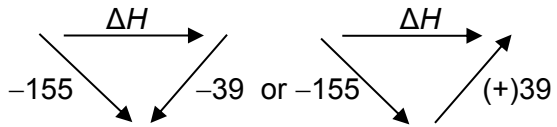
Section A

Question	Answers	Mark	Additional Comments/Guidance
01.1	Not possible to prevent some dissolving	1	ALLOW It is soluble / dissolves / other hydrates may form / suggestions related to difficulty of measuring T (change) of a solid
01.2	($\Delta_{hyd}H$ =) –155 – (–39)	1	OR labelled cycle Minimum needed for 'labelled cycle' 
	–116 (kJ mol^{-1})	1	1/2 for (+)116 or for −29 or for seeing –116 that has then be processed further

01.3 This question is marked using levels of response. Refer to the Mark Scheme Instructions for examiners for guidance on how to mark this question

Level 3 5-6 marks	All stages are covered and the explanation of each stage is correct and virtually complete. Stage 2 must include use of a graphical method for Level 3 (i.e. 'highest T reached' method is max Level 2) Answer communicates the whole explanation, including reference to enthalpy, coherently and shows a logical progression through all three stages. For the answer to be coherent there must be some indication of **how** the graph is used to find ΔT
Level 2 3-4 marks	All stages are covered (NB 'covered' means min 2 from each of stage 1 **and** 3) but the explanation of each stage may be incomplete or may contain inaccuracies **OR** two stages covered and the explanations are generally correct and virtually complete Answer is coherent and shows some progression through all three stages. Some steps in each stage may be out of order and incomplete
Level 1 1-2 marks	Two stages are covered but the explanation of each stage may be incomplete or may contain inaccuracies **OR** only one stage is covered but the explanation is generally correct and virtually complete Answer shows some progression between two stages
Level 0 0 marks	Insufficient correct Chemistry to warrant a mark

6

Indicative Chemistry content

Stage 1 Method

(1a) Measures water with named appropriate apparatus
(1b) Suitable volume/mass / volume/mass in range 10 – 200 cm^3/g
(1c) Into insulated container / polystyrene cup (NOT just 'lid')
(1d) Add known mass of $MgCl_2$(s)
(1e) Use of 'before and after' weighing method. NOT 'added with washings'

Stage 2 Measurements (could mark from diagram)

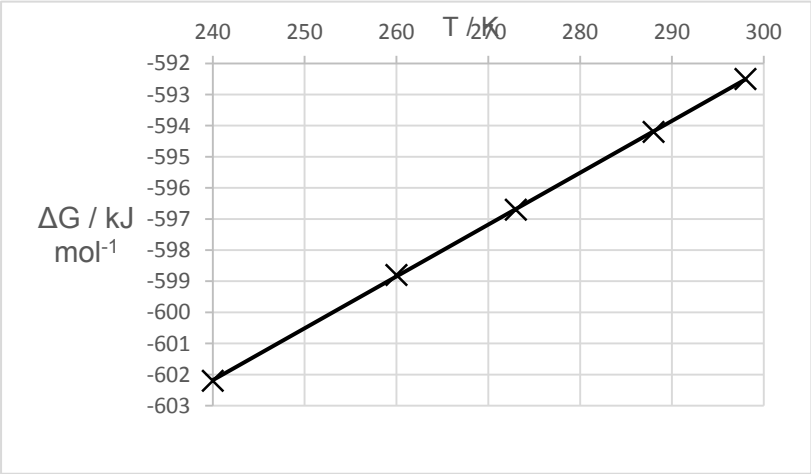
(2a) Record initial temperature (min 2 measurements)
(2b) Record T at regular timed intervals for 5+ mins / until trend seen
(2c) Plot T vs time

Stage 3 Use of Results (3a and 3b could come from diagram)

(3a) Extrapolate lines to when solid added (to find initial and final T)
(3b) $T_{final} - T_{initial} = \Delta T$ / idea of finding ΔT from graph at point of addition
(3c) $q = mc\Delta T$
(3d) amount = mass/M_r ($0.80/95.3 = 8.39 \times 10^{-3}$ mol)
(3e) $\Delta H_{soln} = -q/8.39 \times 10^{-3}$ or in words

This could all be described in words without showing actual calculations but describing stages

If method based on 'combustion' Max Level 1

Question	Answers	Mark	Additional Comments/Guidance
01.4		2	M1 = 5 points correctly plotted M2 = line drawn correctly (NOT if curved, doubled or kinked) (Check line of best fit – if through 250, -600.5 and 280, -595.5 +/- one small square then award M2, if all crosses on line award M1 as well)
	Gradient = $\Delta(\Delta G)/\Delta T$ = 0.167 (kJ K^{-1} mol^{-1})	1	
	($\Delta G = \Delta H - T\Delta S$ so gradient = $-\Delta S$)		
	ΔS = –167 (J K^{-1} mol^{-1})	1+1	M4 = unit conversion i.e. M3 x1000; M5 = –sign (process marks) Correct answer with sign gets M3, M4 and M5 ALLOW –163 to –171

Total		14	