

Revision Sheet

A-Level Chemistry · Unit 23 Chemical energetics

6 vocabulary items · 47 marks of exam questions (4 questions)

Part 1 · Vocabulary review answer key. Section A wants the exact English spelling.

Question	Answer	Marks
1	entropy	1
2	enthalpy change of atomisation	1
3	lattice energy	1
4	electron affinity	1
5	enthalpy change of hydration	1
6	enthalpy change of solution	1

7(a)(i)	<ul style="list-style-type: none"> enthalpy change / energy change one mole of electrons (gained by) one mole of gaseous atoms <p>two for one mark, three for two marks</p>
7(a)(ii)	(energy required to overcome) the repulsion between the electron and anion / negative ion
7(a)(iii)	<ul style="list-style-type: none"> less negative / less exothermic down the group greater the distance between the nucleus and (the shells of the) electrons OR atomic radii increases OR more shielding by inner shells the less attraction between nucleus and incoming electron (and the less energy released) <p>two for one mark, three for two marks</p>
7(b)	<p>M1 use of correct seven numbers only in calculation / energy cycle M2 only 2 × used correctly M3 correct signs and evaluation ecf</p> <p> $-208 = 131 + 906 + 1733 + 62 + 151 + 2x - 2605$ $2x = -586$ $x = -293 \text{ kJ mol}^{-1}$ </p>
7(c)	<p>first box ticked AND Cd²⁺ larger / Cd²⁺ lower charge density AND less attraction between the ions / weaker ionic bonds</p>

8(a)	<table><tr><th>energy change</th><th>always positive</th><th>always negative</th><th>can be either negative or positive</th></tr><tr><td>bond energy</td><td>✓</td><td></td><td></td></tr><tr><td>enthalpy change of atomisation</td><td>✓</td><td></td><td></td></tr><tr><td>enthalpy change of formation</td><td></td><td></td><td>✓</td></tr></table>	energy change	always positive	always negative	can be either negative or positive	bond energy	✓			enthalpy change of atomisation	✓			enthalpy change of formation			✓
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8(b)	M1 (enthalpy change) when one mole of gaseous atoms is produced IGNORE energy released M2 from its element(s) in its standard state / standard conditions / 298 K AND 1 atm																
8(c)	M1 use of correct six numbers only −31 / 285 / 731 / −141 / 798 / 496 M2 2 × used correctly with Ag (2 × 285 (570) and 2 × 731 (1462)) AND 0.5 with O=O (496 (248)) M3 correct signs and evaluation −31 = (2 × 285) + (2 × 731) + (−141) + (798) + x + (0.5 × 496) x = −2968 kJ mol ^{−1}																
8(d)	<table><tr><td>• Ag₂Se <i>least exothermic</i></td><td>Ag₂S</td><td>Ag₂O <i>most exothermic</i></td><td>OWTTE</td></tr></table> <ul style="list-style-type: none">charge density of anion decreases down the group ORA / radius/size of anion increases down the group / Se^{2−} largest radius / O^{2−} smallest radius / O has smallest ionic radiusless attraction between the ions / ionic bond gets weaker (with Ag₂Se) ORA <p>Any two [1], all three [2]</p>	• Ag ₂ Se <i>least exothermic</i>	Ag ₂ S	Ag ₂ O <i>most exothermic</i>	OWTTE												
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8(e)(i)	(K _{sp} =) [Ag ⁺] ² [SO ₃ ^{2−}]																

8(e)(ii)	$x = \sqrt[3]{1.5 \times 10^{-14} / 4} = 1.55 \times 10^{-5} \text{ (mol dm}^{-3}\text{)}$ $[\text{Ag}^+] = 1.55 \times 10^{-5} \times 2 = 3.11 \times 10^{-5} \text{ (mol dm}^{-3}\text{)}$ min 2sf ecf (e)(i)
8(f)	<ul style="list-style-type: none"> feasibility / it increases as temperature increases ORA ΔS is positive / ΔS is >0 / entropy change is positive (and ΔH is positive) OR $-T\Delta S$ becomes more negative / $T\Delta S$ becomes more positive as ΔG becomes / is negative / $\Delta G < 0$ Any two [1], all three [2]

9(a)	M1 magnesium > calcium > strontium M2 ΔH_{latt} and ΔH_{hyd} both become less exothermic / less negative M3 ΔH_{latt} changes less OR ΔH_{hyd} is dominant factor M4 ΔH_{sol} becomes less exothermic / less negative / more positive / more endothermic
9(b)	M1 ΔH / energy change when 1 mole of an ionic solid / compound is formed M2 from gaseous ions (under standard conditions)
9(c)	M1 as ionic radii increases AND ΔH_{latt} less exothermic M2 as ionic charge increases AND ΔH_{latt} increases/more exothermic
9(d)(i)	<p>any two [1] any three [2] all four [3]</p>
9(d)(ii)	M1 selection of ONLY six correct values (–381, 89, 419, 279, –200, 640) AND use of $\times 2$ as only multiplier with K M2 correct evaluation of data used ecf $-381 = (89 \times 2) + (419 \times 2) + 279 + (-200) + 640 + \Delta H_{\text{latt}}^\circ$ $\Delta H_{\text{latt}}^\circ = -2116 \text{ (kJ mol}^{-1}\text{)}$

10(a)	<ul style="list-style-type: none"> enthalpy / energy change / given out / evolved / released one mole is formed / made [1] of compound / solid / lattice / crystal (from) gaseous ions [1]
10(b)b	$\text{S}^-(\text{g}) + \text{e}^- \rightarrow \text{S}^{2-}(\text{g})$ [1]
10(c)c	$(555 + 200 - 532 = 223, 223 \times 8 = 1784)$ M1 selecting correct data 555, 200, 532 only , (ignore signs and multipliers) [1] M2 evaluation to give +223 [1] M3 multiplying M2 by 8 and evaluation ans (+) 1784 [1]
10(d)	$(1619 + 555 - 2612 = -438)$ M1 selecting correct data 1619 555 2612 only, (ignore signs and multipliers) [1] M2 evaluation to give –438 [1]
10(e)(i)	ionic radius / size / sum of ionic radii [1] ionic charge / product of ionic charges [1]
10(e)(ii)	M1 (size tends to make $\Delta H_{\text{latt}}^\circ$ of radium sulfide) less exothermic since the ions are larger [1] M2 (charge tends to make $\Delta H_{\text{latt}}^\circ$ of radium sulfide) less exothermic since the ions are more highly charged [1]
10(e)(iii)	(ionic) charge (since) AND $\Delta H_{\text{latt}}^\circ$ of radium sulfide is more exothermic [1]