

## **TOPIC 10 HW MS**

1. atoms	(a)	Enthalpy change/heat energy change when one mole of g	aseous
		Allow explanation with an equation that includes state symbols	1
	Forn	m (one mole of) gaseous negative ions (with a single charge If ionisation/ionisation energy implied, CE=0 for both marks Ignore conditions	
(b)		prine (atom) is smaller than chlorine/shielding is less/ outer strons closer to	1
	nuci	Fluorine molecules/ions/charge density CE=0 for both marks	v 1
	(Bon	nd pair of) electrons attracted more strongly to the nucleus/	protons
(c)	Fluo	or <u>ide</u> (ions) smaller (than chloride) / have larger charge den Any reference to electronegativity CE=0	sity
	So (i	negative charge) attracts ( + hydrogen on) water more stro Allow H on water, do not allow O on water Allow F - hydrogen bonds to water, chloride ion Δ does not Mark independently	-
(d)	(i) (ii)	<ul> <li>H(solution) = LE - (nydration enthalpies) / correct cycle AgF<sub>2</sub> or other wrong formula CE = 0 Ignore state symbols in cycle</li> <li>LE = -20 - (-464 + -506)</li> <li>= (+) 950 kJ mol<sup>-1</sup> Ignore no units, penalise M3 for wrong units -950 scores max 1 mark out of 3 990 loses M3 but M1 and M2 may be correct 808 is transfer error (AE) scores 2 marks 848 max 1 if M1 correct 1456 CE=0 (results from AgF<sub>2</sub>)</li> </ul>	1 1
	(ii)	There is an increase in the number of particles / more dis less order Allow incorrect formulae and numbers provided number increases Do not penalise reference to atoms/molecules Ignore incorrect reference to liquid rather than solution	order /
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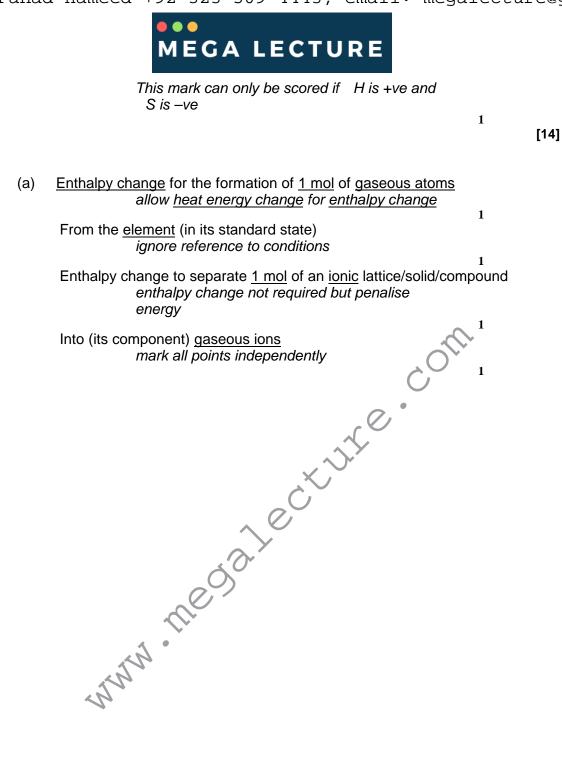
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		(iii) Entropy change is positive/entropy increases and enthal change negative/exothermic	ру
		So G is (always) negative	1
		So G is (always) negative	1 [12]
2.	(a)	Because it is a <u>gas</u> compared with <u>solid</u> carbon Mark independently	
		Nitrogen is more disordered/random/chaotic/free to move	1
			1
	(b)	0 K/-273 C/absolute zero	1
	(c)	$\begin{array}{rcl} G=&H-T~S\\ &Allow~H=&G-T~S\\ T~S=&H-~G\\ &S=(~H-~G)/T &\leq\\ &Ignore  e \ in~G^\circ\end{array}$	1
	( <b>d</b> )	G is less than or equal to zero $(G \ 0)$ Allow G is less than zero $(G < 0)$ Allow G is equal to zero $(G = 0)$ Allow G is negative	1
	(e)	When $G = 0$ $T = \underline{H}$ S	1
		H = +90.4	1
		Allow $H = +90$	1
		S = S(products) - S(reactants)	1
		S = 211.1 - 205.3/2 - 192.2/2 = 12.35	1
			1
		$T = (90.4 \times 1000)/12.35 = 7320 \text{ K}/7319.8 \text{ K}$ Allow 7230 to 7350 K (Note 7.32 K scores 4 marks) Units of temperature essential to score the mark	
	<b>(F</b> )		1
	( <b>f</b> )	Activation energy is high Allow chemical explanation of activation energy Allow needs route with lower activation energy Allow catalyst lowers activation energy	
	(g)	$H = 1.9 (kJ m o l_{-1})$	1
		S = 2.4 - 5.7 = -3.3 (J K-1 mol-1) for M1 and M2 allow no units, penalise wrong	1
		units	
		G is always positive	1

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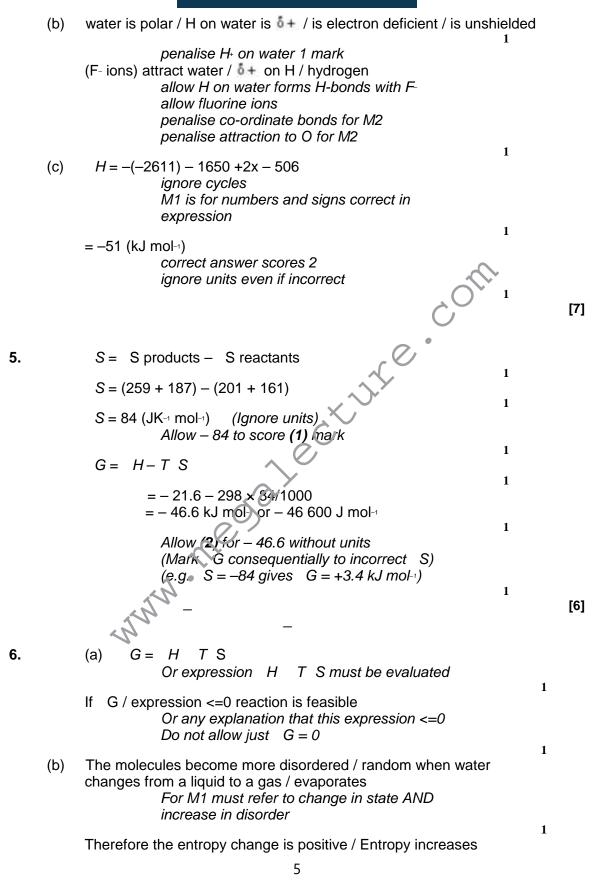
4443,	email:	megalecture@gmai

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(b	) <i>H</i> ∟	= $-H_t + H_a + I.E. + 1/2E(CI-CI) + EA$ Or correct Born-Haber cycle drawn out		
	= +4	411 + 109 + 494 + 121 – 364	1	
	= +7	771 (kJ mol-1) -771 scores 2/3 +892 scores 1/3 -51 scores 1/3 -892 scores zero +51 scores zero ignore units	1	
(c	) (i)	lons are perfect spheres (or point charges)	1	
		<u>Only</u> electrostatic attraction/no covalent interaction mention of molecules/intermolecular forces/covalent bonds CE = 0 allow ionic bonding <u>only</u> If mention of atoms $CE = 0$ for M2	1	
	(ii)	Ionic		
	(iii)	Allow no covalent character/bonding	1	
	(,	Ionic with additional covalent bonding Or has covalent character/partially covalent Allow mention of polarisation of ions or description of polarisation	1	[11]
(a	) (i)	(Enthalpy change for formation of) 1 mol (of CaF <sub>2</sub> ) from allow heat energy change do not allow energy or wrong formula for CaF <sub>2</sub> penalise 1 mol of ions CE=0 if atoms or elements or molecules mentioned ignore conditions	its ions	
		ions in the gaseous state ions can be mentioned in M1 to score in M2 allow fluorine ions Ca²+(g) + 2F-(g) CaF₂ scores M1 and M2	1	
	(ii)	<ul> <li>(enthalpy change when) 1 mol of gaseous (fluoride)</li> <li>ions (is converted) into aqueous ions / an aqueous solu</li> <li>allow F-(g) F-(aq) (ignore + aq)</li> <li>do not penalise energy instead of enthalpy</li> <li>allow fluorine ions</li> <li>do not allow F- ions surrounded by water</li> </ul>		
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Only score M2 if M1 awarded

T S> H Allow M3 for T is large / high (provided M2 is scored) G<0

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Mark M3, M4 independently



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Condition is T = H / S(c) (i) 1  $S = 189 \quad 205 / 2$ 131 = 44.5;1 H = 242 therefore  $T = (242 \times 1000) / 44.5)$ 1 = 5438 K (allow 5400 5500 K) Units essential (so 5438 alone scores 3 out of 4) 2719 K allow score of 2 5.4 (K) scores 2 for M1 and M2 only 1646 (K) scores 1 for M1 only 1 It would decompose into hydrogen and oxygen / its (ii) elements Can score this mark if mentioned in M2 1 Because G for this reaction would be  $\leq 0$ Allow the reverse reaction / decomposition is feasible Only score M2 if M1 awarded 1 (d) H = T S Allow-correct substituted values instead of symbols 1 S = 70 189 = 119 JK 1 mol 1 1  $H = (119 \times 373) / 1000 = 44.4 \text{ kJ} (\text{mol}) (\text{allow} 44 \text{ to} 45)$ Allow 44000 to 45000 J (mol 1) Answer must have correct units of kJ or J 1 [15] 7. Standard enthalpy change, H:  $H_{R}$  = (a)  $H_{\rm foroducts}$  -H<sub>freactants</sub> (1) or cycle  $H_{R} = (0 - [2 \times -242]) - (4 \times -92)$  (1) -484 + 368 -116 (kJ mol-1) Allow max 1 for +116 Standard entropy change,  $S^{\odot}$ : S = H<sub>f products</sub> — H<sub>f reactants</sub>  $S = ([2 \times 223] + [2 \times 189]) - (205 + [4 \times 187])$  (1) = 824 - 953 = -129 (J K<sup>-1</sup> mol<sup>-1</sup>) allow max one for +129 6 Effect: Equilibrium displaced to right / to products (1) (b) (i) *Explanation*: Reaction is endothermic (1) Constraint reduced (1) mark separately Feasible when  $G \leq 0$  (1) (ii) 7

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G = H - T S(1)T = H/ S = 208 × 1000 (1) / 253 = 822 K (1)

[13]

7

8.	C	[1]
9.	С	
		[1]



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