23. Chemical energetics

23.3 Entropy change, ΔS

Paper 4

Marking Scheme

Q1.

(b)(i)	measure / degree of disorder / randomness of a system **OR** the number of possible arrangements of the particles and the energy in a system	**1**

Q2.

(a)(i)	(number of possible) arrangements of particles / energy in a system OR measure / degree of disorder in / of a system [1]	**1**
(a)(ii)	positive / + AND more gas molecules / particles in products OR more moles / molecules in products / RHS [1]	**1**

Q3.

(e)(i)	number of possible arrangements of particles and energy in a system	**1**

(e)(ii)	ΔS is positive **AND** $KCl(s) \rightarrow K^+(aq) + Cl^-(aq)$ / ionic lattice solid forms aqueous **ions OWTTE** [1] **OR** ΔS is positive **AND** ΔG is (therefore becomes) negative / TΔS is greater than ΔH_{sol} **OWTTE** [1]	**1**
(e)(iii)	**more soluble** **AND** ΔG is more negative at higher T / TΔS is more positive at higher T / –TΔS is more negative at higher **ecf from (e)(ii)** [sign ΔS]	**1**

Q4.

(e)(i)	negative **and** reduction in number of gas molecules	**1**

Q5.

(c)(i)	measure / degree of (dis)order / randomness (of a system) **OR** the number of possible arrangements of the particles and their energy (in a given system)	**1**
(c)(ii)	<table><tr><th></th><th>ΔS is negative</th><th>ΔS is zero</th><th>ΔS is positive</th></tr><tr><td>solid dissolving in water</td><td></td><td></td><td>✓</td></tr><tr><td>water solidifying to ice</td><td>✓</td><td></td><td></td></tr></table>	**1**

Q6.

(a)	a **measure / degree** of **disorder / randomness** of a system	**1**
(b)	**M1:** negative – molecules have less energy in the system **M2:** positive – solid being converted into an aqueous solution **M3:** negative – gaseous ions being converted into a solid	**3**

Q7.

(a)	**M1:** correct use of stoichiometry **M2:** answer + 189	**2**

(c)	negative **and** decrease in number / amount of gas molecules	**1**