Solutions

Each answer shows the steps, then the **result**.

2.1

- the number of possible arrangements of the particles and their energy in a system

2.2

- negative

2.3

- **positive**: one solid becomes two moles of gas, so disorder increases

2.4

- **negative**: three moles of gas become two, so disorder decreases

3.1 B

- A solid producing a gas gives the largest increase in entropy

3.2 C

- A gas has the highest entropy

3.3

(a)

- $\Delta S^{\ominus} = \sum S(\text{products}) - \sum S(\text{reactants});\ = 2(193) - [192 + 3(131)] = 386 - 585 = -199\ \text{J K}^{-1}\text{mol}^{-1}$

(b)

- negative – 4 moles of gas become 2 moles, so the disorder decreases

3.4

- the solid lattice breaks up and its ions/molecules spread out and mix among the water molecules, giving many more arrangements, so the entropy increases

3.5

(a)

- $\Delta S^{\ominus} = \sum S^{\ominus}(\text{products}) - \sum S^{\ominus}(\text{reactants}) = (135 + 189 + 214) - 2(102)$
- $\Delta S^{\ominus} = +\mathbf{334}\ \text{J K}^{-1}\text{mol}^{-1}$

(b)

- two moles of gas are formed from solids, so there are many more ways to arrange the particles and energy

3.6

- $H_2O(s) < H_2O(l) < H_2O(g)$
- particles become more free to move from solid to liquid to gas, so disorder increases