Phase change: ice & water

General Chemistry, CH102 Spring 2011

1. In the phase change ice → water …

0% 1. heat is **given off to** surroundings, so $\Delta H_{sys} < 0$
0% 2. heat is **absorbed from** surroundings, so $\Delta H_{sys} > 0$
0% 3. Heat is neither given off nor absorbed

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2. In the phase change ice → water, the entropy of the (ice and water) **system** …

0% 1. goes up, so $\Delta S_{sys} > 0$
0% 2. goes down, so $\Delta S_{sys} < 0$
0% 3. does not change, so $\Delta S_{sys} = 0$

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3. In the phase change ice → water, the entropy of the **surroundings** …

0% 1. goes up, so $\Delta S_{sur} > 0$
0% 2. goes down, so $\Delta S_{sur} < 0$
0% 3. does not change, so $\Delta S_{sur} = 0$

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4. In the phase change ice → water, we know that $\Delta S_{sys} > 0$ and that $\Delta S_{sur} < 0$. In terms of the magnitudes of these entropy changes, this means that we can express the total entropy change as ..

0% 1. $\Delta S_{tot} = +|\Delta S_{sys}| + |\Delta S_{sur}|$
0% 2. $\Delta S_{tot} = -|\Delta S_{sys}| + |\Delta S_{sur}|$
0% 3. $\Delta S_{tot} = +|\Delta S_{sys}| - |\Delta S_{sur}|$

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5. In the phase change ice → water, we know that $\Delta S_{sys} > 0$ and that $\Delta S_{sur} < 0$, and so that $\Delta S_{tot} = +|\Delta S_{sys}| - |\Delta S_{sur}|$. At **0 °C**, it must be true that … [Hint: What do we know about ice → water at 0 °C?]

0% 1. $|\Delta S_{sys}| = |\Delta S_{sur}|$
0% 2. $|\Delta S_{sys}| > |\Delta S_{sur}|$
0% 3. $|\Delta S_{sys}| < |\Delta S_{sur}|$

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6. In the phase change ice → water, we know that $\Delta S_{sys} > 0$ and that $\Delta S_{sur} < 0$, and so that $\Delta S_{tot} = +|\Delta S_{sys}| - |\Delta S_{sur}|$. At **+10 °C**, it must be true that … [Hint: What do we know about ice → water at +10 °C?]

0% 1. $|\Delta S_{sys}| = |\Delta S_{sur}|$
0% 2. $|\Delta S_{sys}| > |\Delta S_{sur}|$
0% 3. $|\Delta S_{sys}| < |\Delta S_{sur}|$

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7. In the phase change ice → water, we know that $\Delta S_{sys} > 0$ and that $\Delta S_{sur} < 0$, and so that $\Delta S_{tot} = +|\Delta S_{sys}| - |\Delta S_{sur}|$. At **−10 °C**, it must be true that … [Hint: What do we know about ice → water at −10 °C?]

0% 1. $|\Delta S_{sys}| = |\Delta S_{sur}|$
0% 2. $|\Delta S_{sys}| > |\Delta S_{sur}|$
0% 3. $|\Delta S_{sys}| < |\Delta S_{sur}|$

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8. In the phase change ice → water, to a good approximation, $|\Delta S_{sys}, -10\ ^{o}C| = |\Delta S_{sys}, 0\ ^{o}C| = |\Delta S_{sys}, +10\ ^{o}C|$. Therefore, which of the following **must** be true about $|\Delta S_{sur}|$?

0% 1. $|\Delta S_{sur}, -10\ ^{o}C| = |\Delta S_{sur}, 0\ ^{o}C| = |\Delta S_{sur}, +10\ ^{o}C|$
0% 2. $|\Delta S_{sur}, -10\ ^{o}C| > |\Delta S_{sur}, 0\ ^{o}C| > |\Delta S_{sur}, +10\ ^{o}C|$
0% 3. $|\Delta S_{sur}, -10\ ^{o}C| < |\Delta S_{sur}, 0\ ^{o}C| < |\Delta S_{sur}, +10\ ^{o}C|$

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9. In the phase change ice → water, we know that it must be that $|\Delta S_{sur}, -10\ ^{o}C| > |\Delta S_{sur}, 0\ ^{o}C| > |\Delta S_{sur}, +10\ ^{o}C|$. Which of the following accounts for this?

0% 1. $|\Delta S_{sur}| = |\Delta H_{sur}/T|$ and so **goes down** with T
0% 2. $|\Delta S_{sur}| = |\Delta H_{sur}|$ and **does not change** with T
0% 3. $|\Delta S_{sur}| = |\Delta H_{sur} \cdot T|$ and so **goes up** with T

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