

[TP] When $NaHCO_3(s)$ is dissolved in 200 mL of $HCl(aq)$, $CO_2(g)$, bubbles form. This means the chemical reaction between the $NaHCO_3(s)$ and the $HCl(aq)$ results in the chemical system ...

25% 1. doing work and so $w > 0$
25% 2. doing work and so $w < 0$
25% 3. having work done on it and so $w > 0$
25% 4. having work done on it and so $w < 0$

Lecture 23 CH101 A1 (MWF 9 am)

Wednesday, November 2, 2016

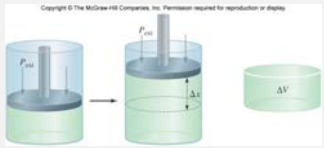
- Complete: Detecting heat and work
- Amount of heat depends on whether there is work

Next lecture: Complete: Amount of heat depends on whether there is work; temperature equilibration; heating curves

How do we know if work is present?

How do we know if work is present?

Macroscopic movement, for example a piston.



Work done by gas: force × distance = $(F/A) \times (\Delta x A) = P_{ext} \Delta V$

Work done on gas: $w = -P_{ext} \Delta V$

Expansion of gas pushes against P_{ext}, gas expends energy, $w < 0$

Compression of gas pushed on by P_{ext}, gas gains energy, $w > 0$

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The amount of heat depends on whether there is work

$\Delta U = q_V$ can be different from $\Delta H = q_P$

Express this in a sentence, without using symbols or jargon

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Heat depends on whether there is work

The reaction

$$NaHCO_3(s) + H_3O^+(aq) \rightarrow CO_2(g) + Na^+(aq) + 2\ H_2O(l)$$

Is measured to be endothermic, $q > 0$ (solution/surroundings cool).

How much cooling is there at constant volume (q_V) compared to that at constant pressure (q_P)?

Let's learn how to predict what we expect…

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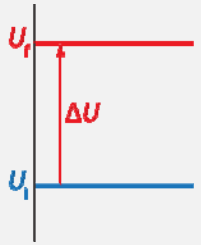
Heat depends on whether there is work

The reaction $NaHCO_3(s) + H_3O^+(aq) \rightarrow CO_2(g) + Na^+(aq) + 2\ H_2O(l)$ is endothermic, $q > 0$ (solution/surroundings cool). Sketch the energy diagram for this reaction: Indicate the initial and final energy by horizontal lines labeled U_i and U_f, respectively, and connect the lines by an arrow labeled ΔU.



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[TP] The reaction $NaHCO_3(s) + H_3O^+(aq) \rightarrow CO_2(g) + Na^+(aq) + 2\ H_2O(l)$ is endothermic, $q > 0$ (solution/surroundings cool). How will U_i change depending on whether the reaction is run in a sealed flask (constant V) or an open flask (constant P)?

33% 1. U_i change will not change
33% 2. U_i change will change depending on work w
33% 3. Cannot know without further information

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[TP] The reaction $NaHCO_3(s) + H_3O^+(aq) \rightarrow CO_2(g) + Na^+(aq) + 2\ H_2O(l)$ is endothermic, $q > 0$ (solution/surroundings cool). How will U_f change depending on whether the reaction is run in a sealed flask (constant V) or an open flask (constant P)?

33% 1. U_f change will not change
33% 2. U_f change will change depending on work w
33% 3. Cannot know without further information

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[Quiz] The reaction $NaHCO_3(s) + H_3O^+(aq) \rightarrow CO_2(g) + Na^+(aq) + 2\ H_2O(l)$ is endothermic, $q > 0$ (solution/surroundings cool). How will ΔU change depending on whether the reaction is run in a sealed flask (constant V) or an open flask (constant P)?

33% 1. ΔU will not change
33% 2. ΔU will change depending on work w
33% 3. Cannot know without further information

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