[TP] Pure water at 50 °C is measured to have a pH of 6.63.
This means that pure water at 50 °C is ...

33% 1. acidic
33% 2. neutral
33% 3. basic

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Lecture 15 CH102 A1 (MWF 9:05 am)

Friday, February 24, 2017

Being ch14: Acid-base equilibria
- The pH of water
- Composition of liquid water

Next lecture: Continue ch14: Weak acids and strong acids.

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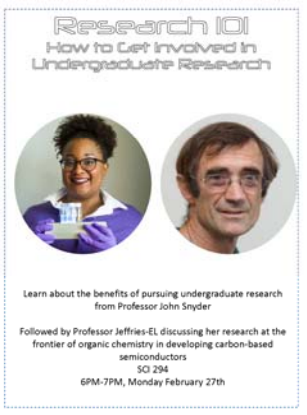
Research 101

How to get involved in undergraduate research

Monday, February 27
6pm, SCI/294



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Begin ch14:

Acid-base equilibria in aqueous solutions

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The pH of water

Write down the chemical equilibrium that accounts for the pH of water.

$H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$

The pH of water

Write down the reaction quotient for the water autoionization equilibrium,

$H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$

$Q_w = [H_2O]^2 = [H_3O^+]\,[OH^-]$

$K_w = [H_2O]_e^{\,2} = [H_3O^+]_e\,[OH^-]_e$

The pH of water

Pure water at 50 °C is measured to have a pH of 6.63.

Write down the value of $[H_3O^+]_e$ at 50 °C.

$[H_3O^+]_e = 10^{-6.63} = 2.34 \times 10^{-7}$

The pH of water

Pure water at 50 °C is measured to have a pH of 6.63.

Write down the value of $[OH^-]_e$ at 50 °C.

$[OH^-]_e = [H_3O^+]_e = 10^{-6.63} = 2.34 \times 10^{-7}$

The pH of water

Pure water at 50 °C is measured to have a pH of 6.63.

Write down the value of the reaction quotient of the water autoionization at equilibrium at 50 °C.

$$Q_{w,e} = K_w = [H_3O^+]_e\,[OH^-]_e = (10^{-6.63})^2 = 5.48 \times 10^{-14}$$

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[TP] Pure water at 50 °C is measured to have a pH of 6.63.
This means that pure water at 50 °C is ...

33% 1. acidic
33% 2. neutral
33% 3. basic

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[TP] Pure water at 10 °C has $[H_3O^+] = 5.39 \times 10^{-8}$.
This means that pure water at 10 °C is ...

33% 1. acidic
33% 2. neutral
33% 3. basic

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[Quiz] The pH of pure water is different at different temperatures.
This means that as temperature changes ...

20% 1. the proportions of $H_3O^+(aq)$ and $OH^-(aq)$ to one another in pure water change
20% 2. the acidity of pure water changes
20% 3. the value of the equilibrium constant changes
20% 4. All of the above
20% 5. None of the above

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Response Counter

10

Equilibrium constants change with temperature

If A ⇌ B is endothermic (gains energy from it surroundings), its K increases with temperature.

If A ⇌ B is exothermic (loses energy to its surroundings), its K decreases with temperature.

[TP] The pH of pure water at 50 °C is 6.63. The pH of pure water at 25 °C is 7.00. This means the autoionization of water,

$H_2O(l) + H_2O(l) \rightleftharpoons H_3O^+(aq) + OH^-(aq)$

is ...

33% 1. Exothermic
33% 2. Endothermic
33% 3. More information needed to know

Response Counter

10

Composition of liquid water

Liquid water

Using chevrons (/\) to represent water molecules, make a sketch of liquid water. Show about 50 water molecules in your sketch. Remember to represent liquid water rather than solid water (ice).

[TP] Based on your sketch (rather than on what you anticipate to be the correct answer), calculate to one significant figure the pH of the water.

14% 1. −1
14% 2. 1
14% 3. 7
14% 4. 10
14% 5. 14
14% 6. ∞
14% 7. Something else

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Response Counter

10

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Liquid water

Modify your sketch of liquid water to add 5 hydronium ions (represented as a circled "+") and 5 hydroxide ions (represented as a circled "−").

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