

[TP] What do you expect to be true about the process
$Cl^-(0.0001\ M) \rightarrow Cl^-(1\ M)$?

25% 1. $E > 0$
25% 2. $E = 0$
25% 3. $E < 0$
25% 4. More information needed

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Lecture 28 CH102 A2 (MWF 11:15 am)

Monday, April 8, 2019

- Concentration cells: Mixing → electric current

Next lecture: Begin ch 17: Spontaneous change: How far?
- The essence of change
- Counting particle dispersal
- Maximum particle dispersal = uniform pressure

Notes: Spontaneity: Second law of thermodynamics
http://quantum.bu.edu/courses/ch102-spring-2018/handouts.html

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Concentration cells: Mixing → electric current

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Concentration cells: Mixing → electric current

What happens when ink is dropped into water?

It disperses spontaneously

What happens when salt water is dropped into fresh water?

It disperses spontaneously

Let's see how to harness such spontaneity of mixing …

to generate electricity!

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25% 3. $E < 0$
25% 4. More information needed

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[TP] What do you expect to be true about the process
$Cl^-(1\ M) \rightarrow Cl^-(0.0001\ M)$?

1. $E > 0$
2. $E = 0$
3. $E < 0$
4. More information needed

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[TP] What is true about the process
$Cl^-(1\ M) \rightarrow Cl^-(0.0001\ M)$?

25% 1. $K > 1$
25% 2. $K = 1$
25% 3. $K < 1$
25% 4. More information needed

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[TP] What is true about the process
$Cl^-(1\ M) \rightarrow Cl^-(0.0001\ M)$?

1. $E° > 0$
2. $E° = 0$
3. $E° < 0$
4. More information needed

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[TP] The process

$Cl^-(1\ M) \rightleftarrows Cl^-(0.0001\ M)$

is spontaneous. The correct cell line notation is …

1. Pt(s) | Cl^-(0.0001 M) | Cl_2 (1 bar) || Cl^-(1 M) | Cl_2 (1 bar) | Pt(s)
2. Pt(s) | Cl^-(0.0001 M) | Cl_2 (1 bar) || Cl_2 (1 bar) | Cl^-(1 M) | Pt(s)
3. Pt(s) | Cl^-(1 M) | Cl_2 (1 bar) || Cl^-(0.0001 M) | Cl_2 (1 bar) | Pt(s)
4. Pt(s) | Cl^-(1 M) | Cl_2 (1 bar) || Cl_2 (1 bar) | Cl^-(0.0001 M) | Pt(s)
5. None of the above

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Concentration cell construction

Sketch the construction of a chloride concentration cell.

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[Group Quiz] The voltage of a chloride concentration cell is x V. If the pressure of the chlorine gas in the anode is doubled, the new voltage will …

25% 1. be larger than x V.
25% 2. remain x V.
25% 3. be smaller than x V.
25% 4. Further information needed.

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[Group Quiz] A concentration cell is constructed with Q corresponding to the Cl^- concentration difference between sea water and river water at 25 °C. Assume that the Cl^- concentration (due to dissolved NaCl) of sea water is 35 g/L and than that of river water is 0.10 mg/L. The voltage of this cell is …

20% 1. $E = +0.67$ V
20% 2. $E = +0.50$ V
20% 3. $E = +0.33$ V
20% 4. $E = +0.17$ V
20% 5. Something else

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Recipe for concentration cell reaction and Q

1. Write skeleton reaction, for example
   $A^+(\text{conc}, aq) \rightarrow A^+(\text{dil}, aq)$ or
   $B^-(\text{conc}, aq) \rightarrow B^-(\text{dil}, aq)$
2. Write half reaction for reactant and for product, labelling each component as being in anode or cathode.

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2. Write half reaction for reactant and for product, labelling each component as being in anode or cathode.
3. Combine half reactions, noting the value of n_e.
4. Write expression for Q
5. Use $E = -\frac{0.06}{n_e}\,\text{V}\,\log(Q)$

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