

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] At 25 °C

$$E = E^\circ - (0.06/n_e) V \log(Q)$$
 What is the value of E when everything is in **standard states**?

25% 1. $E = \infty$
 25% 2. $E = 0$
 25% 3. $E = E^\circ$
 25% 4. None of the above

BOSTON UNIVERSITY 1

Lecture 28 CH102 A1 (MWF 9:05 am)
 Wednesday, April 5, 2017

- Exploring the Nernst equation.
- Concentration cells: Mixing → electric current

Next lecture: Complete concentration cells.
 Begin ch17: Spontaneous change: How far?

Notes: Spontaneity: Second law of thermodynamics
<http://quantum.bu.edu/courses/ch102-spring-2017/handouts.html>

BOSTON UNIVERSITY

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

Exploring the Nernst equation

BOSTON UNIVERSITY 7

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] At 25 °C

$$E = E^\circ - (0.06/n_e) V \log(Q)$$
 What is the value of E when everything is in **standard states**?

25% 1. $E = \infty$
 25% 2. $E = 0$
 25% 3. $E = E^\circ$
 25% 4. None of the above

BOSTON UNIVERSITY 8

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[Quiz] At 25 °C

$$E = E^\circ - (0.06/n_e) V \log(Q)$$
 What is the value of E when everything is **at equilibrium**?

25% 1. $E = \infty$
 25% 2. $E = 0$
 25% 3. $E = E^\circ$
 25% 4. None of the above

BOSTON UNIVERSITY 9

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] At 25 °C

$$E = E^\circ - (0.06/n_e) V \log(Q)$$
 What is the value of E when there are **no products** present?

25% 1. $E = \infty$
 25% 2. $E = 0$
 25% 3. $E = E^\circ$
 25% 4. None of the above

BOSTON UNIVERSITY 10

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] At 25 °C

$$E = E^\circ - (0.06/n_e) V \log(Q)$$
 What is the value of E when there are **only products** present?

25% 1. $E = \infty$
 25% 2. $E = 0$
 25% 3. $E = E^\circ$
 25% 4. None of the above

BOSTON UNIVERSITY 11

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] For $A + B \rightleftharpoons 2 C + D$ at 25 °C

$$E^\circ = (0.06/n_e) V \log(K)$$
 What is the value of the **equilibrium constant** for
 $2 A + 2 B \rightleftharpoons 4 C + 2 D$?


17% 1. K
 17% 2. $2 K$
 17% 3. K^2
 17% 4. $K/2$
 17% 5. $K^{1/2}$
 17% 6. None of the above

BOSTON UNIVERSITY 12

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] For $A + B \rightleftharpoons 2 C + D$ at 25 °C
 $E^\circ = (0.06/n_e) V \log(K)$
 What is the value of n_e for
 $2 A + 2 B \rightleftharpoons 4 C + 2 D$?


17% 1. n_e
 17% 2. $2 n_e$
 17% 3. n_e^2
 17% 4. $n_e / 2$
 17% 5. $n_e^{1/2}$
 17% 6. None of the above

 13

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] For $A + B \rightleftharpoons 2 C + D$ at 25 °C
 $E^\circ = (0.06/n_e) V \log(K)$
 What is the value of E° for
 $2 A + 2 B \rightleftharpoons 4 C + 2 D$?


17% 1. E°
 17% 2. $2 E^\circ$
 17% 3. $(E^\circ)^2$
 17% 4. $E^\circ / 2$
 17% 5. $(E^\circ)^{1/2}$
 17% 6. None of the above

 14

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[TP] For $A + B \rightleftharpoons 2 C + D$ at 25 °C
 $E^\circ = (0.06/n_e) V \log(K)$
 What is the value of E° when **all concentrations are doubled**?


17% 1. E°
 17% 2. $2 E^\circ$
 17% 3. $(E^\circ)^2$
 17% 4. $E^\circ / 2$
 17% 5. $(E^\circ)^{1/2}$
 17% 6. None of the above

 15

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[Quiz] For $A + B \rightleftharpoons 2 C + D$ at 25 °C, if $E = 5.0 V$, $E^\circ = 2.0 V$, and $n_e = 1$,
 what is the value of E when **all concentrations are doubled**?

17% 1. $E < 5.0 V$
 17% 2. $E = 5.0 V$
 17% 3. $E > 5.0 V$
 17% 4. $(E)^2$
 17% 5. $E / 2$
 17% 6. $(E)^{1/2}$

 16

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

Concentration cells: Mixing → electric current

BOSTON UNIVERSITY

17

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

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!**

BOSTON UNIVERSITY

18

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

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

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

BOSTON UNIVERSITY

Response Counter

10

19

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

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

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

BOSTON UNIVERSITY

Response Counter



10

20

Lecture 28 CH102 A1 (MWF 9 am) Spring 2017 Copyright © 2016 Dan Dill dan@bu.edu

[Group Quiz] What is true about the process
 $\text{Cl}^-(1 \text{ M}) \rightarrow \text{Cl}^-(0.0001 \text{ M})$?

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

 Response Counter  21