Announcements – Lecture XXI – Tuesday, Dec 1st

1. Final Lab – Saturday, December 5th … 1-4pm … ISB 155/160 (A-E)

   a) Print lab prior to coming to lab -- use the 'Print Friendly Version' located on the top left hand side of the page – this is the version that contains the 'Data Sheet' that you will hand in upon completing the lab.

   b) The pre-lab quiz associated with this lab is the 'TA Evaluation' that that can be found in your Class Owls. Completing this by Friday, December 11th is equivalent to a perfect quiz score.

2. Third Exam – Tuesday December 8th – 1:00-2:15pm – In Class

   3 or 4 questions will be taken from Lab Owls 3, 4 and 5.

3. 

   iClicker:

   Choose any letter: A-E

8.11 How do We Calculate the pH of a Buffer?

$$HA_{(aq)} + H_2O_{(l)} \rightleftharpoons H_3O^+ + A^- \qquad K_a = \frac{[H_3O^+][A^-]}{[HA]}$$

$$[H_3O^+] = K_a\left([HA]/[A^-]\right)$$

$$\log_{10}[H_3O^+] = \log_{10}K_a + \log_{10}[HA] - \log_{10}[A^-]$$

$$-\log_{10}[H_3O^+] = -\log_{10}K_a + \log_{10}[A^-] - \log_{10}[HA]$$

$$pH = pK_a + \log_{10}\left([A^-]/[HA]\right)$$

HA = Weak acid = Buffer acid.

A^- = Conjugate base = Buffer base.

Buffer pH: $pH = pK_a + \log_{10}\frac{[\text{Buffer base}]}{[\text{Buffer acid}]}$

↳ Henderson - Hasselbalch Equation.

8.11 How do We Calculate the pH of a Buffer?

MAIN QUESTION

Question

A solution contains the following components

0.208 M HCO_2H
0.376 M $NaHCO_2$

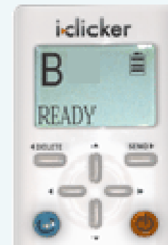
What is the pH of the solution?

Ka HCO_2H = 1.8×10^{-4}

Answer

Enter a response, then Submit.

4



Buffer Acid : $[HCO_2H] = 0.208$

Buffer Base : $[HCO_2^-] = 0.376$

$$pH = pK_a + \log_{10}\frac{[\text{Buffer Base}]}{[\text{Buffer Acid}]}$$

$$= -\log_{10}(1.8 \times 10^{-4}) + \log_{10}\left(\frac{0.376}{0.208}\right)$$

$$= 3.745 + \log_{10}(1.807)$$

$$= 3.745 + 0.257$$

$$= 4.002$$

8.11 Buffers – A Summary

a) Buffer : Buffer acid + Buffer base — Weak acid plus its conjugate base.

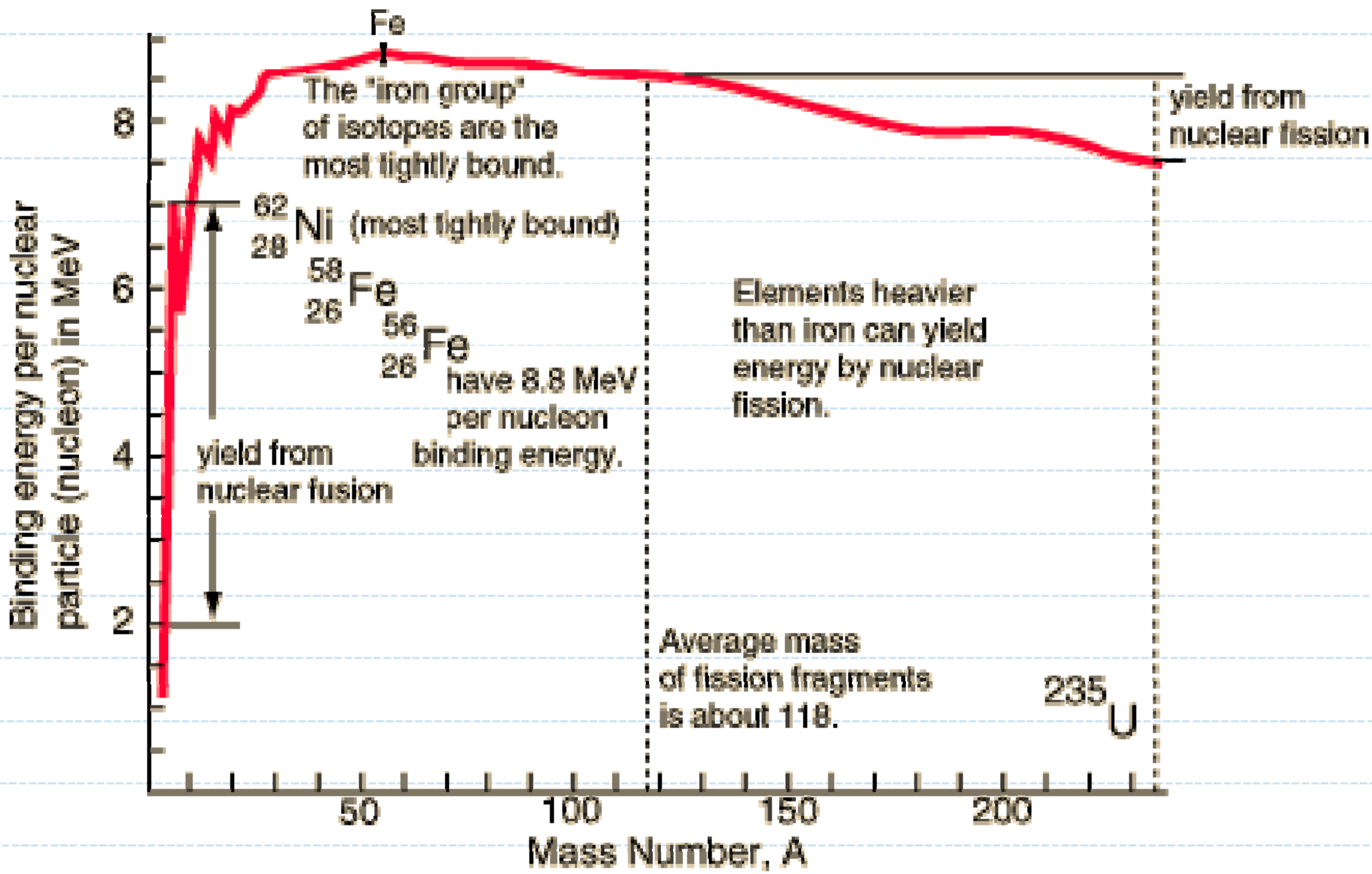
b) [Buffer acid] = [Buffer base] — pH of Buffer = pKa of the Buffer acid.

c) Buffer Capacity — = concentration of the Buffer acid or Buffer base.

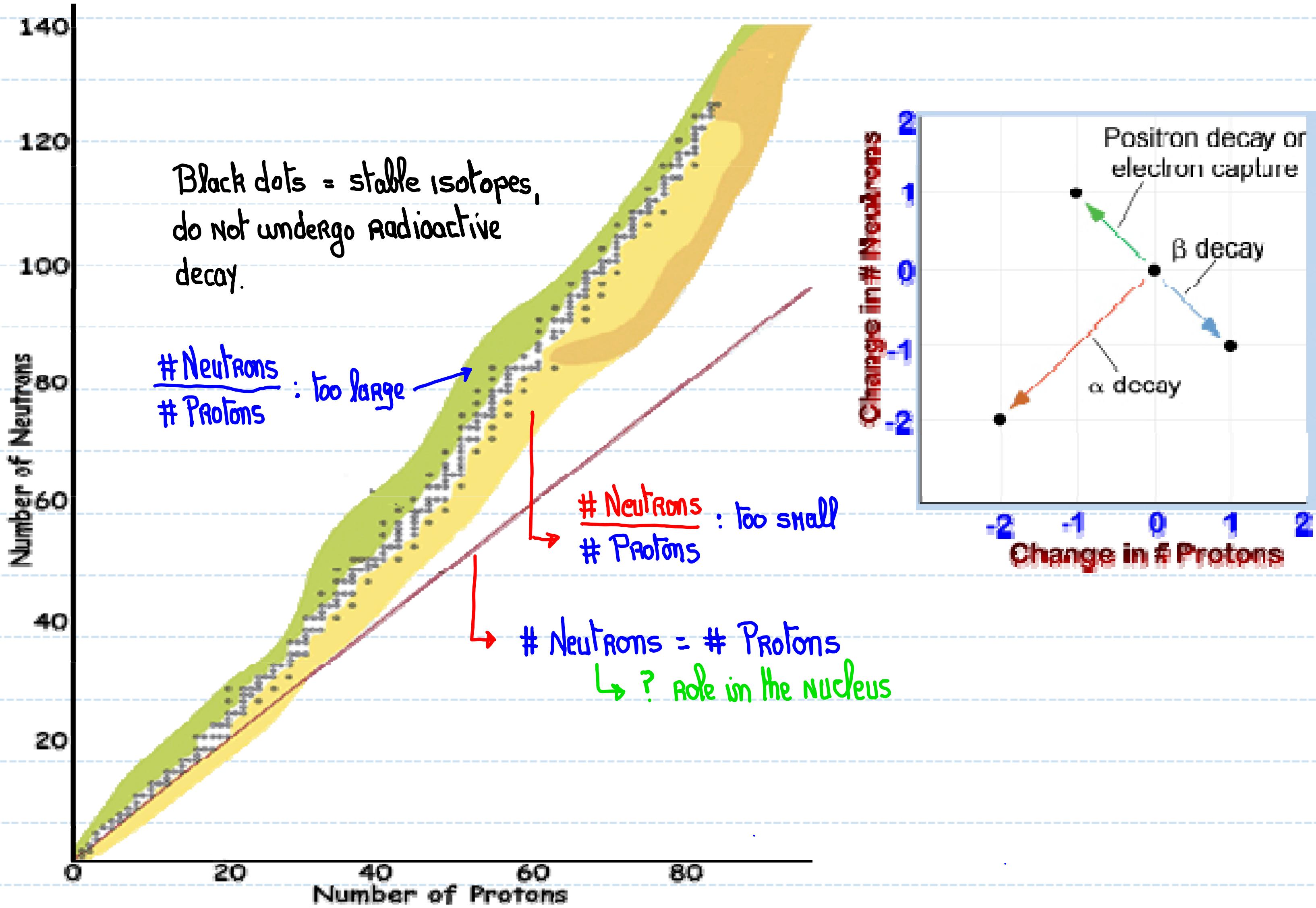
d) How a Buffer works — OH^- + Buffer acid = $H_2O(l)$ + Buffer base.
H_3O^+ + Buffer base = $H_2O(l)$ + Buffer acid.

e) Buffer pH — $pH = pKa + \log_{10}\left(\frac{[\text{Buffer base}]}{[\text{Buffer acid}]}\right)$

9.3 Binding Energy – Nuclear Fusion Vs Nuclear Fission



9.3 Nuclei Stability Zone?



9.3 What Happens When a Nucleus Emits Radioactivity

Decay Methods

1. Alpha Emission:

$^{4}_{2}\alpha$ or $^{4}_{2}He$ ... OWL $_{2}He^{4}$

2. Beta Emission :

$^{0}_{-1}\beta$ or $^{0}_{-1}e$ ... OWL $_{-1}e^{0}$

3. Positron Emission:

$^{0}_{+1}\beta$ or $^{0}_{+1}e$ ... OWL $_{+1}e^{0}$

4. Nucleus captures an electron ... Electron Capture:

$^{0}_{-1}e$

Note 1, 2 and 3: The emitted particle is a products.

4: The captured electron is a reactant.

9.3 What Happens When a Nucleus Emits Radioactivity

What's happening in the Nucleus – emitting $^{0}_{-1}e$, $^{0}_{+1}e$ and capturing $^{0}_{-1}e$ – a simplistic approach.

2. Nucleus emitting a $^{0}_{-1}\beta$ particle ... an electron ... where does this $^{0}_{-1}e$ come from?

$$^{1}_{0}n \rightarrow {}^{1}_{1}H + {}^{0}_{-1}e \text{ (emitted)}$$

Neutron → Proton + Electron (Beta particle)

Net result in nucleus → Neutron converted to a Proton.

3. Nucleus emitting a $^{0}_{+1}\beta$ particle .. a positron ... where does this $^{0}_{+1}e$ come from?

$$^{1}_{1}H \rightarrow {}^{1}_{0}n + {}^{0}_{+1}e \text{ (emitted)}$$

Proton → Neutron + Positron

Net result in nucleus → Proton converted to a Neutron.

9.3 What Happens When a Nucleus Emits Radioactivity

What's happening in the Nucleus – emitting $^{0}_{-1}e$, $^{0}_{+1}e$ and capturing $^{0}_{-1}e$ – a simplistic approach.

4. Nucleus capturing an electron ... why? ... what does the neucleus do with an $^{0}_{+1}e$?

$$^{1}_{1}H + ^{0}_{-1}e \rightarrow ^{1}_{0}n$$

Proton | Captured electron | Neutron

Net result in the Nucleus → Proton converted to a Neutron.