Chem 163-03 Spring 2018

Unit 3

Please note that in the event of school closure, our course content will continue following this Unit Syllabus supplemented by required information from Canvas.

May-9 Outcomes (also in Unit 2 Syllabus)

1. To know the terminology of electrochemical cells, including voltaic cell, electrolytic cell, half reaction, oxidation, reduction, anode, cathode.
2. To review the definitions of redox reactions and how to identify them.
3. To interpret and write half reactions for oxidations and reductions including balance of electrons and charge.
4. To use half reactions to identify what gets oxidized, what gets reduced in redox reactions and describe the substances as reducing agents or oxidizing agents.
5. To combine half reactions into balanced overall reactions.
6. To construct wet cells, measure potentials, and identify anode and cathode.
7. To know and use cell notation, and how it corresponds to half reactions, and overall reactions.

Assignments:

Read Ch. 19, §19.1, 2 (No Reading Quiz); Lab manual p. 67

Worksheet 12 Parts 1&2

May-15 Outcomes

1. To know how Standard Reduction Potentials were obtained and how to find them.
2. To determine standard potentials (cell voltage) for redox reactions from their half-cell potentials and correlate the meanings of $E^o_{cell} = (E^o_{cathode} - E^o_{anode})$ and $E^o_{cell} = (E^o_{red} + E^o_{ox})$.
3. To interpret the standard reduction potentials of half-reactions, and cell potentials of overall reactions as they relate to free energy changes.
4. To relate the standard reduction potential (or standard oxidation potential) to the strength of a reducing or oxidizing agent.
5. To use simple half reactions, or half reactions from a table, to balance redox equations.
6. To be able to evaluate cell potentials under non-standard conditions using the Nernst equation.
7. To determine and interpret potentials of concentration cells and how they relate to ion-selective electrodes (not in text).
8. To describe how concentration cells relate to biological membrane potentials (not in text).
9. To understand how pH could be measured with a hydrogen electrode, and how modern pH electrodes function as concentration cells (not in text).
10. To relate standard potentials to equilibrium constants of redox reactions.

Assignments:

Lab report for Experimental Cell Potentials (pp. 71 – 73 of lab manual file) due at start of class.

Read §19.3 – 19.6

Prepared Problems: Ch. 19, #2 (Cu is the + electrode), 12, 14, 16

May-16 Laboratory

Water Quality Analyses - Methods (Read pp. 76 – 84 of lab manual file; there is no Prelab.) Report due 5/22.

May-17 Outcomes

1. To review the types of batteries described throughout the chapter and relate them to our lab experience.
2. To describe the specific details of the lead-acid automotive battery and the lithium ion battery, and how the lithium ion battery works by a different mechanism.
3. To describe corrosion in electrochemical terms, and how dissimilar metals and/or oxygen lead to corrosion.
4. To define "sacrificial anode" and give examples of how they are used to prevent corrosion.
5. To describe "passivation" as a different mechanism for preventing corrosion (not in text) and give the examples of passivation of aluminum and iron.
6. To know that an electrolysis cell does work, and is non-spontaneous, driven by an external voltage source.
7. To know examples of industrial applications of electrolysis.
8. To be able to convert among amperes, charge, moles of electrons, and moles of reactants and products in electrolysis.
9. To describe the operation of fuel cells.

Assignments:

Read §19.6 – 19.10

Prepared Problems: Ch. 19, #28a, 30 (state why), 36a, b, 38a, b, 48, 54, 92

May-22 Outcomes

1. For α-amino acids, describe and locate amino groups, carboxyl groups, alpha carbons and R groups.
2. To describe differences among R groups regarding charge and polarity and how these affect properties.
3. To view amino acids as zwitterions, and use pKa values to indicate expected charge locations at biological pH values.
4. To define the peptide bond as an amide bond formed from condensation of α-amino acids.
5. To describe and interpret polypeptides as polymers of the α-amino acids, and how once polymerized, the original amino and carboxyl groups along the chain are gone.
6. To predict changes in protein functional groups with pH reflecting on titration curves and buffers.
7. To know and use the terms primary, secondary, tertiary, and quaternary structure of proteins.
8. To describe the forces that create these structures and their origins in bonded, non-bonded and charge interactions.
9. To review the function of enzymes in catalyzing biochemical reactions and learn aspects of regulation.
10. To view (not in text) a rate equation representative of enzyme kinetics (not testable).

Assignments:

Lab report for Water Quality Analyses - Methods (see specifications on p. 78 of lab manual file).

Read §20.1 – 20.2

Graded Homework, due at start of class: Ch. 19, #18, 26 (explain), 28b, 34, 36c, 38c, d, 52, 60 (explain)

Prepared Problems: Ch. 19, #68, 76, 88

May-23 Laboratory

Water Quality Analyses – Week 2: Stream Water Analyses (Read pp. 85 – 86 of lab manual file; there is no Prelab.) Report due 5/29.

Pre-assigned groups of three will carry out stream water analyses on 5/23 and 5/30 according to the lab manual. Each group will present these results along with instructional material on either 6/6 or 6/7.

May-24 Outcomes

1. To know the backbone structure of DNA, the four pendant bases, and its three-dimensional structure.

2. To describe the hydrogen-bond interactions between the base pairs in DNA.
3. To describe how copies of DNA are formed during replication and the relationships between base pairs.
4. To know that the sequence of three base pairs in order provides a code for the assembly of proteins.
5. To know the backbone structure of RNA, and how its sugars and bases differ from DNA.
6. To know how the process of transcription provides an RNA polymer with "information" derived from DNA.
7. To know how the process of translation forms a messenger RNA and the action of transfer RNA provides a protein with a specific sequence of amino acids.
8. Given a table of base sequences, be able to describe a sequence of amino acids in the resulting protein polymer.
9. To describe the process of transcription, translation, protein assembly, and the location of each.
10. To review the definitions of isotopes and isotope notation.
11. To know that isotopes vary in natural abundance, and that some are radioactive.
12. To know definitions and masses, charges, and notations for protons, neutrons, electrons, beta particles, positrons, alpha particles, and gamma rays.
13. To communicate the difference between chemical stability and nuclear stability.
14. To be able to quantify the relationship between matter and energy and show how the interrelationship applies in nuclear reactions.
15. To be able to write nuclear reactions with notations for mass and atomic number.
16. To be able to write specific examples of nuclear decay reactions.
17. Given a decay series, to be able to describe the specific events taking place.
18. To relate half-lives to percentages of radioactive nuclei present.

Assignments:

Read §20.5 and 21.1 – 21.3

Prepared Problems: Ch. 20, #12, 20, 22 (consider only R groups), 26a, b

May-29 Outcomes

1. To understand the rates of radioactive decay as first-order kinetic processes.
2. To know how to calculate activity as a function of time and the meaning and implications of half-life.
3. To be able to use decay calculations in radioactive dating.
4. To use measurements of activity in rate-of-decay problems.
5. To know biological effects of radiation and how radiation damage is quantified.
6. To understand the applications of radiochemistry in tracer analysis, imaging, radioactive therapy, and positron emission tomography.
7. To describe, and give examples of spontaneous and induced fission reactions.
8. To know how a nuclear chain reaction is initiated and progresses.
9. To know the schematic of a light-water nuclear reactor, and its implications for nuclear safety.
10. To know the definition of, and give an example of a fusion reaction.
11. To understand the fundamental differences between fission and fusion reactions.

Assignments:

Lab report for Water Quality Analyses – Week 2: Stream Water Analyses (see specifications on p. 86 of lab manual file).

Read §21.4 – 21.9

Prepared Problems: Ch. 20, #64; What is the sequence of mRNA formed opposite the sequence of each nucleotide in Practice exercise, p. 995; what peptides would correspond to these segments? Ch. 21, #14, 18, 22, 34. See Graded Homework on next page.

Graded Homework, due at start of class: Ch. 20, #26c, 74. For #74, use the information pI(glutamic acid) = 3.08, pI(arginine) = 10.8, pI(tryptophan) = 5.9.

In the Practice exercise sequence (p. 995), what peptides would result if the first nucleotide was missing?
Ch. 21 #20, 36.

May-30 Laboratory

Water Quality Analyses – Week 3: Stream Water Analyses (Read pp. 85 – 86 of lab manual file; there is no Prelab.) Report due 5/31. Note that this due date is the day after lab.

Class-Wide Data for Presentations available on Canvas May-30 at about 6:30 pm.
PLEASE NOTE that the preview pane in Canvas (what you get when you click on a file) allows you to view, but not use Excel. Click on the Download tab at the top, and the file will display and/or download according to your browser settings.

May-31 Outcomes

1. To collaborate on problem-solving on a Group Sheet.
2. Success on the Unit 3 examination, based on outcomes in Unit 3 and related topics from lab.

Assignments:

Lab report for Water Quality Analyses – Week 3: Stream Water Analyses (see specifications on p. 86 of lab manual file). Note that this report is due the day after lab.

Laboratory notebooks due for second grading. Your Week 2 and Week 3 reports should contain all the data needed for preparing your presentation. You are strongly encouraged to have your Data Summary for your presentation completed as early as possible.

Prepared Problems: Ch. 21, #43 (show work), 56, 64, 68, 76

Jun-5 Outcomes

1. To collaborate on presentation preparation.

Please note that while this is a required session, you may choose to hold it at a place and time agreeable to your group. There should be no conflicts at class time, and our classroom is available.

Jun-6 Water Quality Analysis Presentations

Normally a lab date, location to be determined. This is the first of two sessions. Each student must attend each presentation and participate in assessment to receive full presentation credit.

Group Data Summaries due for presenting groups.

Jun-7 Water Quality Analysis Presentations

In our usual classroom. This is the second of two sessions. Each student must attend each presentation and participate in assessment to receive full presentation credit.

Group Data Summaries due for presenting groups.

Group Sheet 4 (8 points, content based on Water Quality Analyses).