Chem 309 – Sp 12

Chapter 1: Measurement, Atoms, and Elements
Study Guide and Homework

Be able to:

1. apply unit analysis to calculations and conversions that utilize the metric and/or English unit systems
2. apply the rules of significant figures to calculations
3. describe the structure of atoms
4. relate isotopes to average atomic mass and percent abundance
5. determine the number of valence electrons in main group elements
6. distinguish between metals and non-metals

On-line Homework: refer to Web Assign website

Text Homework

Matter & Measurement	Elements & Atomic Structure	Periodic Table of Elements
1.61 a-d	1.105	1.131
1.63	1.107	1.133
1.67 a-c	1.109 a-e	1.135 a-b
1.71 a-c	1.111 a-c	1.139 a-b
1.73 a-d	1.113	1.141
1.75 a-d	1.115	1.143 a-b
1.79 a-d	1.117	
1.85	1.118	Model Tool Kit 1-1
1.93	1.119	Question 2 a & b
1.97	1.121	
1.99	1.122	
1.101	1.123	

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Chapter 2: Compounds
Study Guide and Homework

Be able to:

1. recognize and differentiate between ionic and covalent compounds
2. name and write the chemical formulae of cations, anions and ionic compounds
3. write Leis structures for covalent compounds
4. calculate the molar mass of compounds
5. convert between mass in grams and moles of a compound

On-line Homework: refer to Web Assign website

Text Homework

Ionic Cpds	Covalent Cpds	Cpds w/ Polyatomic Ions	Molar Masses
2.47	2.69	2.87 a-c	2.99
2.51	2.72	2.89 a-c	2.101
2.53 a-e	2.73 a-d	2.91 a-d	2.103
2.55	2.75 a-e	2.93 a-d	2.105
2.61 a-f	2.77	2.95 a-c	2.107
2.63 a-f	2.79 a-e		2.111
2.67 a-e	2.81		2.115 a-b
	2.83		2.119

Model Tool Kit 2-1
Parts 1 to 10

Refer to the following blood chemistry panel to answer the pre-chapter reading assignment for chapter 2.

Blood chemistry panel for Jane Doe

Ion or Molecule	Value	Normal Range
Urea	12 mg/dL	7 – 20 mg/dL
Albumin	4.8 g/dL	3.9 – 5.0 g/dL
Glucose	120 mg/dL	64 – 128 mg/dL
Potassium	8.6	3.7 – 5.2 mEq/L
Cholesterol	250 mg/dL	100 – 240 mg/dL

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Chapter 3: Shapes of Molecules and their Interactions
Study Guide and Homework

Be able to:

1. predict the electron and molecular geometry and bond angles of covalent compounds
2. predict molecular polarity
3. compare the electronegativity of elements
4. identify the IMFs of a compound

Please prepare the following models and bring them to lecture. We will combine them in various ways during lecture to build larger molecules and learn about molecular shape.

Color code

C = black
H = small white balls
O = red
N = blue
X = green

Models to make

1) CH_3O (1 C bonded to 3 H's and 1 O)
2) CH_3CO (2 C bonded together; 1 of the C's is bonded to 3 H's and 1 of the C's is double bonded to an O)
3) CH_3 (1 C bonded to 3 H's)
4) HCN (This formula is a complete molecule.)
5) NH_2 (1 N bonded to 2 H's)
6) OH (1 O bonded to 1 H)

On-line Homework: refer to Web Assign website

3-D Shape	Modeling	IMF	Model Tool Kit 3-1
3.21 a-c	3.47	3.67	Inquiry Questions
3.23		3.69	1 through 11
3.25	Molecular Polarity	3.71	
3.35	3.55	3.73 a-c	
3.43	3.57	3.75	
	3.61 a-c	3.79	

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Chapter 4: Solids, Liquids and Gases
Study Guide and Homework

Be able to:

1. distinguish between kinetic energy and potential energy
2. describe pressure units and perform calculations that include pressure units
3. convert between temperature units: °C, °F, and K
4. apply the Kinetic Theory of Matter to gases, liquids and solids
5. relate IMFs to physical characteristics
6. solve gas phase calculations using Boyles' Law, Dalton's Law and Henry's Law

On-line Homework: refer to Web Assign website

Homework from Text Book

States of Matter	Changes of State	Pressure	Gases
4.59 a-d	4.77	4.91	4.111
4.65	4.79	4.93 a-b	4.115
4.71	4.83	4.97	4.133
4.73	4.85		4.135
4.75			

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Chapter 5: Solutions, Colloids, and Membranes
Study Guide and Homework

Be able to:

1. distinguish between homogeneous and heterogeneous mixtures
2. relate IMFs to solution formation
3. convert between the following concentration units: m/v; %(w/v); molarity; and Eq/vol
4. perform dosage calculations
5. perform dilution calculations
6. distinguish between solutions, colloids, and suspensions
7. explain the differences between diffusion, osmosis and dialysis
8. predict the fate of red blood cells when exposed to solutions of varying concentrations

On-line Homework: refer to Web Assign website

Text Homework

Mixtures	Sol'n Concentrations	Colloids & Suspensions	Membranes, Osmosis & Dialysis
5.43 a-d	5.47	5.77 a-f	5.85 a-c
	5.51		5.87
	5.53		5.89
	5.55		5.91
	5.59		
	5.63		
	5.67		
	5.69		

Chapter 6: Hydrocarbons and Structure
Study Guide and Homework

Bring Model Kits to Lecture – prepare CH_2CH_2 and $CH_3CH_2CH_2CH_2CH_3$

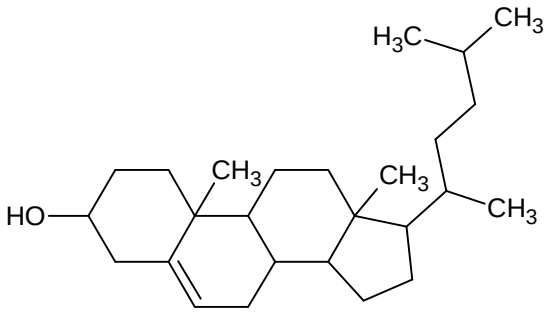
Be able to:

1. distinguish between molecular formulae of alkanes, alkenes, alkynes and aromatic benzene rings
2. distinguish between structural isomers, conformers, and geometric isomers (cis/trans)
3. convert between the Lewis structure, skeletal (bond-line structure), and condensed structural formula of organic compounds
4. give the IUPAC name and structural formula (Lewis, bond-line or condensed) for alkanes, alkenes, alkynes, benzene, toluene, phenol, aniline, benzaldehyde, and benzoic acid.
5. describe the structural and physical properties of hydrocarbons
6. predict the relative boiling points and/or solubility of alkanes, alkenes, alkynes, and benzene derivatives

On-line Homework: refer to Web Assign website

Text Homework – For some of the questions, I did not assign ALL of the parts. If you feel like you need more practice, then answer ALL the parts of these questions.

Hydrocarbons	Writing Structures	Nomenclature (Naming Hydrocarbons)	Critical Thinking Question
6.47	6.67 a-c	6.89 a-c	The structure for cholesterol is shown below and on page 491 of our text book.
6.49 a-d	6.69 a-b	6.93 a-c	
6.51 a-e	6.71 a-c	6.95 a-b	
6.53		6.97 d	6.109
Saturated Hydrocarbons	Unsat'd Hydrocarbons (alkenes & alkynes)		
6.55	6.75 a-d	Aromatic Hydrocarbons	Model Tool Kit
6.59	6.79	6.101	6-1: 4a,b & 5
6.63 a-d		6.103	6-2: 2a,b & 3a-f
		6.107	6-3: 2a,b; 5-8a,b
			6-4: 2; Obsv 1-3
			6-5: 3-11; 13; 14 a-f



cholesterol

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Chapter 7: Functional Groups
Study Guide and Homework

Be able to:

1. recognize alcohols, amines, aldehydes, ketones, carboxylic acids, esters, amides, phosphate esters, and thiols and sulfides in large biological molecules and pharmaceutical drugs
2. give the IUPAC name for alcohols, amines, aldehydes, ketones, carboxylic acids, esters, and amides
3. draw the skeletal (bond-line) structure and condensed structure of alcohols, amines, aldehydes, ketones, carboxylic acids, esters, amides, phosphate esters, and thiols and sulfides
4. classify alcohols as primary, secondary, or tertiary
5. classify amines as primary, secondary, tertiary or quaternary
6. relate phosphate ester and phosphate anhydride structure to ADP and ATP

On-line Homework: refer to Web Assign website

Text Homework

ROH & ROR′
7.31 a-e
7.33
7.35
7.39 a-b

RCHO & RCOR′
7.41 a-e
7.43 a-c
7.47 a-c

RCOOR′ & RCOSR′
7.49 a-c
7.51 a-b

$RCONH_2$
7.52 a-c

RNH_2
7.55 a-c

Phosphate Esters
7.57

Model Tool Kit
7-1: 2a-c; 3a-e; 4 a-e
7-2: 2a-h; 3a-d
7-3: 2a-d; 3a-e; 4a-c; 5a-d

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Chapter 8: Chemical Reaction Basics
Study Guide and Homework

Be able to:

1. balance chemical reactions
2. convert and use calories, joules and Calories
3. explain and recognize the differences between exothermic and endothermic reactions (ΔH)
4. calculate the total calories in food from the protein, carbohydrate and fat composition
5. explain and recognize the differences between anabolic and catabolic reactions
6. relate activation energy to reaction rates
7. draw reaction energy diagrams and label the axes, reactants, products, Ea and ΔH
8. relate reactant concentration, temperature, and/or presence of a catalyst to reaction rates

On-line Homework: refer to Web Assign website

Text Homework

Balancing Reactions
8.25 a-d

Energy and Reactions
8.33 a-d
8.39 a-d
8.43 a-b
8.45
8.47
8.49

Reaction Rates (Kinetics)
8.53 a-c
8.55
8.57
8.59

Critical Thinking
8.61
8.65 a-c

Model Tool Kit
8-1: .3; 6-11

Chem 309 – Sp 12

Chapter 9: Acids and Bases
Study Guide and Homework

Be able to:

1. define, recognize and name acids and bases
2. determine and recognize conjugate acid-base pairs
3. distinguish between strong and weak acids and bases
4. predict the products of acid-base neutralization reactions
5. convert between [H3O+], [OH-], pH and pOH
6. show the ionized form of carboxylic acids, phosphates esters and amines at physiological pH
7. apply LeChatlier's equilibrium principles to blood buffer systems
8. relate the changes in reaction conditions to shifts in equilibrium
9. describe and identify the chemical composition of pH buffer systems

On-line Homework: refer to Web Assign website

Text Homework

Acids & Bases
9.25
9.27

Conjugate Acid-Base pairs
9.29 a-d

Strengths of Acids & Bases
9.31
9.33
9.37 a-c
9.39 a-b

Acid-Base Equilibrium
9.41 a-c

Le Chatlier's Principle
9.45 a-b
9.47

Acid-Base Neutralization Rxns
9.49

pH
9.53 a-g
9.55
9.59

Buffers
9.61
9.65 a-d

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Chapter 10: Reactions of Organic Functional Groups
Study Guide and Homework

Be able to:

1. predict the effect of acid-base reactions on the solubility of carboxylic acids and amines
2. explain metabolism, catabolism, and anabolism
3. recognize redox, hydration, dehydration, acyl group transfer, phosphoryl group transfer, acyl derivative hydrolysis, and acyl derivative formation reactions
4. distinguish between the structure and function of the coenzymes: NAD^+ FAD and NADPH
5. predict the products of redox, hydration, dehydration, acyl group transfer, phosphoryl group transfer, acyl derivative hydrolysis, and acyl derivative formation reactions
6. distinguish between phosphate ester and phosphoanhydride bonds

On-line Homework: refer to Web Assign website

Text Homework

Redox Reactions
10.27
10.29
10.31
10.33 a-b
10.35 a-b
10.39 a-b
10.41 a-d
10.43 a-d
10.47 a-b, d

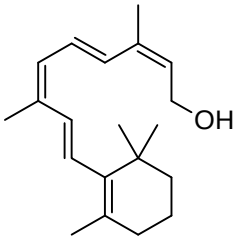
Model Tool Kit
10-1: 4a-e; 5-8

Hydration-Dehydration Reactions
10.51 a-c
10.53 a-b

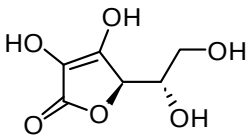
Acyl Group Transfer Reactions
10.55 a*-b
10.57 a-c
10.59 a-c
*The answer in the back of the book is wrong.

Phosphoryl Group Transfer Rxns
10.63 a-c
10.65 a-c

Information for Pre-chapter Reading

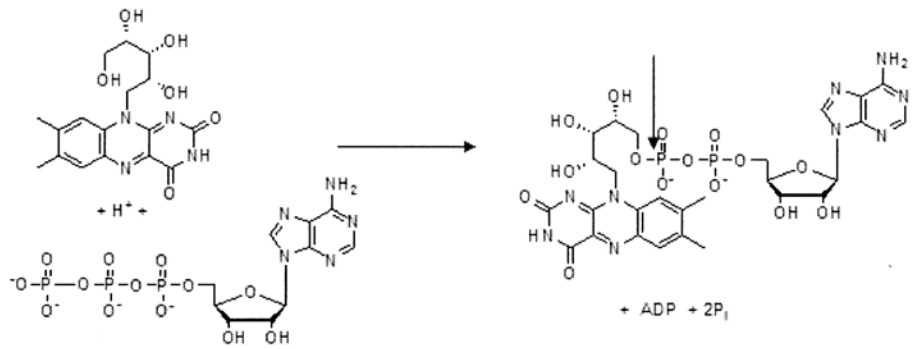


Vitamin A

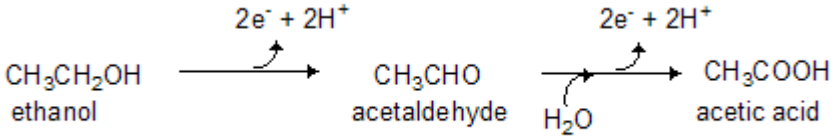


Vitamin C

Refer to the following reaction of FAD as it is produced from riboflavin to answer the question(s) below.



Refer to the following figure, the metabolism of alcohol, to answer the question(s) below.



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Chapter 11: Proteins: Structure and Function
Study Guide and Homework

Bring a model of alanine ($CH_3CH(NH_2)CO_2H$) to lecture

Be able to:

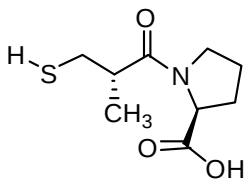
1. write the structure of an amino acid at physiological pH
2. identify the sides chains of amino acids as non-polar, polar, acidic, or basic
3. distinguish between L- and D- amino acids
4. recognize chiral carbons and pairs of enantiomers
5. explain what a racemic mixture is
6. convert between perspective formulas (wedges and dashes) and Fischer projections
7. write the structure for a tripeptide given the amino acid sequence and vice versa
8. identify and explain the IMFs of 2° structure of proteins
9. distinguish between α-helixes and β-sheets
10. explain and distinguish between the main interactions that create 3° structure of proteins
11. identify and explain 4° structure of proteins
12. explain the process of protein denaturation
13. distinguish between the 3 general classes of proteins (fibrous, globular, and membrane)
14. explain the E-S complex and its effect on reaction rates
15. recognize which class of enzyme is catalyzing a biochemical reaction
16. identify and predict the cofactors and coenzymes in a biochemical reaction
17. explain and predict the effects from nonspecific enzyme inhibition
18. explain and predict the effects from specific enzyme inhibition

On-line Homework: refer to Web Assign website

Text Homework

Amino acids	Protein Architecture	Enzymes
11.55	11.75	11.91
	11.77	11.95
Chirality	11.79	11.97
11.61 a-d	11.81	11.99
11.63	11.83	11.101
	11.85	
Peptides	11.87	Model Tool Kit
11.65 a & b	11.89	11-1: Achiral 4a-e; Chiral 3a-e
11.67		11-2: 3; 9-14
11.69 a-d		
11.71		

Information for Pre-chapter reading assignment



Captopril

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Chapter 12: Carbohydrates: Structure and Function
Study Guide and Homework

Bring a model of glyceraldehyde ($CH_2(OH)CH(OH)CO_2H$) to lecture.

Be able to:

1. explain the role of carbohydrates
2. recognize and draw the Fischer and Haworth structures for glucose, galactose, fructose, ribose, lactose, maltose, and sucrose
3. distinguish between D- and L- sugars
4. identify the chiral carbons in a monosaccharide
5. recognize the anomeric carbon and distinguish between the α and β-anomers
6. recognize and classify glycosidic bonds (α or β - #,#)
7. predict the products of the hydrolysis of lactose, maltose, and sucrose
8. explain mutarotation and its consequences
9. explain the role of starch, glycogen and cellulose in plants and/or animals
10. explain the 3 stages of carbohydrate catabolism
11. recognize the chemical reactions that occur during glycolysis and their associated energy
12. describe and explain the fate of pyruvate under aerobic and anaerobic conditions
13. recognize the pathways using glucose: glycogenesis, glycogenolysis, and gluconeogenesis.
14. explain the role of oligosaccharides as cell markers using ABO blood groups

On-line Homework: refer to Web Assign website

Text Homework

Carbohydrate Structure
12.37 a-c
12.39
12.41 a-b
12.43 a-d
12.45 a-d
12.49
12.51

Carbohydrate Catabolism
12.55 a-d
12.57
12.61
12.63
12.65

Model Tool Kit
12-1: 3a-d; 5a-d
12-2: 4-6

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Chapter 13 Lipids: Structure and Function
Study Guide and Homework

Be able to:

1. Describe the chemical structure and general properties of fatty acids, waxes, and oils.
2. Compare the properties of saturated and unsaturated fatty acids; and cis vs. trans fatty acids.
3. Name fatty acids using either the omega or delta system.
4. Predict the products of saponification and enzyme catalyzed hydrolysis of triglycerides (triacylglcerols).
5. Distinguish between the three major types of membrane lipids: phospholipids, glycolipids, and chlolesterol (structure, function, properties).
6. Characterize the structure of a lipid bilayer.
7. Give a general explanation of how molecules and ions get into and out of the cell.
8. Explain the role of cholesterol in membrane structure and in steroid hormone synthesis.
9. Distinguish between types of lipoproteins and their role in cholesterol transport in the body.
10. Give examples of steroid hormones and their role in the body.
11. Characterize the structure and function of bile salts.
12. Describe the structure and function of eicosanoids. What fatty acid(s) are they made from?
13. Describe the process of fatty acid activation. Where in the cell does it occur?
14. Explain where fatty acid oxidation occurs.
15. Predict the number of spirals of beta oxidation that would be needed for a given fatty acid.
16. Describe how the condition of ketoacidosis occurs. What chemical compound is in short supply? Excess? What are ketone bodies?

On-line Homework: refer to Web Assign website

Text Homework

Energy Storage Lipids: Tryglycerides	Fatty acid Catabolism	Model Tool Kit
13.37	13.71	13-1: 4a-d; 5; 6; 7a,b
13.39	13.73	
13.43	13.75	
13.45	13.79	
13.47		
13.51	Cholesterol	
13.55	13.81	
	13.83	
Membrane Lipids	13.85	
13.57		
13.59 a-c	Chemistry in Medicine	
13.61	13.87	
13.63 a-f	13.89	
13/65	13.91 a-b	
13.67	13.93	
13.69	13.95	

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Chapter 14 – Metabolism and Bioenergetics

Be able to:

1. Explain role of Gibbs free energy change (ΔG) in determining if a reaction is exergonic or endogonic, spontaneous or non-spontaneous.
2. Interpret reaction energy diagrams (ΔG vs. reaction progress).
3. Characterize the thermodynamic contributors to reaction spontaneity (ΔH and ΔS).
4. Provide an overview of the sources of our energy and how we use it.
5. Distinguish between catabolic and anabolic reactions. Include the role of energy in these processes.
6. Map out the basic cellular anatomy involved in the generation of biochemical energy in humans.
7. Explain the three major stages of the production of biochemical energy from food. (For each stage state the starting materials and the products, what happens in that stage, and its connection to the overall process.)
8. Explain the significance of the acetyl group in acetyl SCoA. What is an acetyl group? Where do the carbon atoms come from? What is its role in the citric acid cycle?
9. Write a simple reaction for the hydrolysis of acetylCoA.
10. Recognize the structural features and give the complete name of ATP.
11. Distinguish between coupled reactions and reactions that occur sequentially.
12. Characterize the oxidation or reduction of a carbon-based molecule and give some examples.
13. Distinguish between a reduced and an oxidized coenzyme. Give some examples.
14. Explain why reduced coenzymes are called electron carriers.
15. State the main function of the citric acid cycle and list its end products.
16. Classify the enzymes for each reaction of the citric acid cycle using a citric acid cycle diagram.
17. Provide a general scenario of electron transport. Include a description of its participants – protein complexes, electron carriers (including mobile electron carriers). What happens to the energy level as electrons are passed along the electron transport chain?
18. State the main function of oxidative phosphorylation and explain why it is coupled with electron transport. Use the terms electrochemical gradient, proton gradient, potential energy, flow, ATP synthase, driving force, ion channel.

On-line Homework: refer to Web Assign website

Text Homework

Acetyl CoA and CAC
14.23
14.25
14.26
14.27
14.29 a-c
14.31
14.33
14.35

Extension Exercises
14.37
14.39 a-d
14.41 a-d

Oxidative Phosphorylation
14.43
14.47
14.49
14.51
14.53

Entropy & Bioenergetics
14.55
14.57 a-d
14.59 a-e
14.61
14.63 a-d
14.65
14.67 a-c
14.71 a-c
14.73 a-d

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Chapter 15: Nucleic Acids – DNA and RNA
Study Guide and Homework

Be able to:

1. identify the nitrogen base, monosaccharide and phosphate group in a nucleotide and draw the skeletal-line structure
2. distinguish between DNA and RNA and the 3′ and 5′ alcohols
3. draw the skeletal-line structure of a dinucleotide
4. predict the complimentary bases for DNA replication, transcription to mRNA, and translation to tRNA
5. explain the role of IMFs in creating DNA structure
6. compare and contrast the roles of DNA, mRNA, tRNA, and rRNA
7. identify the enzyme needed for DNA replication and protein synthesis
8. explain translation – the process of building a protein from an mRNA template
9. recognize the mutations caused by substitution and frame shifting

On-line Homework: refer to Web Assign website

Text Homework

Nucleotides and Nucleic Acids
15.29
15.31
15.33 a-g
15.37
15.39
15.41

DNA
15.45
15.47
15.51
15.53 a-b
15.55
15.59
15.61
15.63
15.65
15.67 a

RNA
15.69
15.71
15.73 a-b
15.75
15.77
15.79
15.83 a-b
15.85 a-b
15.87 a-b

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Chapter 16: Nuclear Chemistry and Medicine
Study Guide and Homework

Be able to:

1. Explain, compare and contrast the different kinds of radioactivity – α, β, β^+, γ, E.C. including their structure, energy intensity, penetrating ability, health effects
2. Predict the product or reactant of a nuclear reaction
3. Perform calculations using the half-life of a radioisotope
4. Explain how ionizing radiation interacts with matter and can be detected
5. Describe, compare and convert between radiation units systems: Ci, R, rad, rem, Bq, Gy, Sv
6. Describe (with examples) the similarities & differences between fusion & fission
7. Describe (with examples) medical uses of radioisotopes

On-line Homework: refer to Web Assign website

Text Homework

Radioisotopes
16.37
16.39

Electromagnetic Radiation
16.41
16.43
16.45 a-c
16.47 a-b

Types of Radioactive Decay
16.49
16.51
16.53
16.55 a-c

Half-life
16.57
16.59
16.61

Artificial Radioactivity
16.65
16.67

Energy and Penetrating Power of Radiation
16.71
16.73
16.75
16.77 a-c
16.79