

## KJM 3200 – Required Reading (Pensum), Fall 2016

- John McMurry: "Organic Chemistry" 8<sup>nd</sup> ed. *or* Paula Y. Bruice, "Organic Chemistry" 7<sup>nd</sup> ed. as specified below, as specified below.
- Lise-Lotte Gundersen "KJM 3200. Organic Chemistry II. Laboratory manual", Fall 2016

Students who have used "McMurry" or "Bruice" in their first org. chem. course, can continue to use the same book. Students who have used none of these before, are advised to use "McMurry"

*After completing the introductory course in organic chemistry (KJM1110) as well as KJM3200, the intention is that the student shall master the subjects presented in McMurry / Bruice, except most metabolic pathways, polymer chemistry, (and other parts about polymer chemistry and biochemistry elsewhere in the book), and the spectroscopy covered by KJM3000*

### Required reading from "McMurry"

Topic	Chapt.	Title	Ca. No. of pages	
<b>Dienes</b>	<b>14</b>	<b>Conjugated compounds and UV spectroscopy</b>	<b>16</b>	
		14.1		Stability of conjugated dienes: MO theory
		14.2		Electrophilic addition to conjugated dieles: Allylic carbocations
		14.3		Kinetic vs thermodynamic control of reactions
<b>Organo-metallics</b>	<b>10</b>	<b>Organohalides</b>	<b>3</b>	
		10.7		Organometallic coupling reaction
<b>Radical reactions</b>	<b>6</b>	<b>An overview of organic reactions</b>	<b>3</b>	
		6.3		Radical reactions
	<b>8</b>	<b>Alkenes: Reactions and synthesis</b>	<b>4</b>	
		8.10		Radical additions to alkenes
	<b>10</b>	<b>Organohalides</b>	<b>2</b>	
		10.2		Radical halogenation
<b>Reactions of Aldehydes and Ketones</b>	<b>17 &amp; 19</b>	<b>Alcohols and Phenols / Aldehydes and Ketones: Nucleophilic addition reactions</b>	<b>8</b>	
		19.6		Nucleophilic addition of HCN: Cyanohydrin formation
		19.8		Nucleophilic addition of amines: Imine and enamine
		17.18		Protection of alcohols
<b>Carbonyl <math>\alpha</math>-substitutions</b>	<b>22</b>	<b>Carbonyl alpha-substitution reactions (the whole chapt.)</b>	<b>20</b>	
	<b>23</b>	<b>Carbonyl condensation reactions (the whole chapt. except 23.13)</b>	<b>24</b>	
<b>Aromatic compounds</b>	<b>16</b>	<b>Chemistry of benzene: Electrophilic aromatic substitution</b>	<b>4</b>	
		16.7		Nucleophilic aromatic substitution
		16.8		Benzynes
<b>Amines &amp; Heterocycles</b>	<b>24</b>	<b>Amines and heterocycles</b>	<b>10</b>	
		24.6		Synthesis of amines
		24.7		Reactions of amines
		24.8		Reactions of arylamines

		24.9	Heterocyclic amines	
<b>Carbo- hydrates</b>	<b>25</b>	<b>Biomolecules: Carbohydrates</b>		<b>29</b>
		25.1	Classification of carbohydrates	
		25.2	Depicting carbohydrate stereochemistry: Fisher projections	
		25.3	D,L Sugars	
		25.4	Configuration of aldoses	
		25.5	Cyclic structures of monosaccharides: Anomers	
		25.6	Reactions of monosaccharides	
		25.8	Disaccharides	
		25.9	Polysaccharides and theirs synthesis	
<b>Amino acids, peptides etc</b>	<b>26 and 24</b>	<b>Biomolecules: Amino acids, peptides and proteins (the whole chapt. 26 except 26.9-26.11)</b>		<b>23</b>
		24.5	Biological amines and the Henderson-Hasselbach Eq.	
<b>Lipids, terpenoids etc</b>	<b>27</b>	<b>Biomolecules: Lipids</b>		<b>22</b>
		27.1	Waxes, fats and oil	
		27.2	Soap	
		27.5	Terpenoids	
		27.6	Stereoids (not steroid hormones)	
		27.7	Biosynthesis of stereoids	
<b>Nucleic acids</b>	<b>28</b>	<b>Biomolecules: Nucleic acids</b>		<b>9</b>
		28.1	Nucleotides and Nucleic acids	
		28.2	Base pairing in DNA: The Watson-Crick Model	
		28.7	DNA synthesis	
<b>Pericyclic reactions</b>	<b>8</b>	<b>Alkenes: Reactions and Synthesis</b>		<b>3</b>
		8.9	Addition of carbenes to alkenes: Cyclopropan e synthesis	
	<b>14</b>	<b>Conjugated compounds and UV spectroscopy</b>		<b>5</b>
		14.4	The Diels Alder cycloaddition reaction	
		14.5	Charachteristics of the Diels Alder reaction	
	<b>18</b>	<b>Ethers and epoxides; thiols and sulfides</b>		<b>2</b>
		18.4	Reactions of ethers: Claisen rearrangement	
	<b>30</b>	<b>Orbitals and organic chemistry: Pericyclic reactions (the whole chapt.)</b>		<b>18</b>
<b>Total No. of pages*</b>				<b>203</b>

\* The number of pages does not include exercises, Highlights "A deeper look", "etc.

Required reading from "Bruice"

Topic	Chapt.	Title	Ca. No. of pages	
Dienes	8	<b>Delocalized Electrons and Their Effect on Stability, pKa, and the Products of a Reaction</b>	11	
		8.14		A molecular orbital description of stability
		8.17		Reactions of Dienes
		8.18		Thermodynamic versus kinetic control
Organo-metallics	12	<b>Organometallic compounds</b>	9	
		12.2		Transmetallation
		12.3		Organocuprates
		12.4		Palladium-catalyzed coupling reactions
		12.5		Alkene metathesis
Radical reactions	13	<b>Radicals - Reactions with alkanes</b>	9	
		13.4		The distribution of products depends on probability and reactivity
		13.5		The reactivity-selectivity principle
		13.7		The addition of radicals to an alkene
		13.8		The stereochemistry of radical substitution and addition reactions
Reactions of Aldehydes and Ketones	17	<b>Reactions of Aldehydes and Ketones. More Reactions of Carboxylic Acid Derivatives. Reactions of <math>\alpha,\beta</math>-Unsaturated Carbonyl Compounds</b>	18	
		17.6		The reactions of aldehydes and ketones with cyanide ion
		17.10		The reactions of aldehydes and ketones with amine
		17.13		Protecting groups
		17.14		The addition of sulfur nucleophiles
		17.15		The reactions of aldehydes and ketones with a peroxy acid
		17.17		Designing a synthesis: Disconnection, synthons, and synthetic equivalents
		17.18-19		Nucleophilic addition to $\alpha,\beta$ -unsaturated carbonyl compounds
Carbonyl $\alpha$ -substitutions	18	<b>Reactions at the <math>\alpha</math>-Carbon of Carbonyl Compounds (The whole chapt. except 18.21)</b>	31	
Aromatic compounds	19	<b>Reactions of Benzene and Substituted Benzenes</b>	3	
		8.12		A molecular orbital description of aromaticity and antiaromaticity
		19.21		Nucleophilic aromatic substitution: an addition-elimination reaction
Amines & Heterocycles	20 (+ some parts of 11,	<b>More About Amines – Reactions of Heterocyclic Compounds</b>	20	
		20.3		Amines react as bases and as nucleophiles
		11.9		Amines do not undergo substitution or elimination reactions
		11.10		Quaternary ammonium hydroxides undergo elimination reactions

	<b>16 and 19)</b>	20.4	The synthesis of amines + appendix	
		16.18	The hydrolysis of an imide: A way to synthesize primary amines	
		19.21	The synthesis of substituted benzenes using arenediazonium salts	
		19.22	The arenediazonium ion as an electrophile	
		19.23	The mechanism for the reaction of amines with nitrous acid	
		20.5	Aromatic five-membered-ring heterocycles	
		20.6	Aromatic six-membered-ring heterocycles	
		20.7	Some amine heterocycles have important roles in Nature	
<b>Carbo- hydrates</b>	<b>21</b>	<b>The organic chemistry of Carbohydrates</b>		<b>24</b>
		21.1	Classification of carbohydrates	
		21.2	The D and L notation	
		21.3	The configuration of aldoses	
		21.4	The configuration of ketoses	
		21.5	The reactions of monosaccharides in basic solutions	
		21.6	The oxidation-reduction reactions of monosaccharides	
		21.7	Lengthening the chain: The Kilani-Fischer synthesis	
		21.8	Shortening the chain: The Wohl degradation	
		21.9	The stereochemistry of glucose: The Fisher proof	
		21.10	Monosaccharides from cyclic hemiacetals	
		21.11	Glucose is the most stable aldohexose	
		21.12	Formation of glycosides	
		21.13	The anomeric effect	
		21.14	Reducing and nonreducing sugars	
		21.15	Disaccharides	
21.16	Polysaccharides			
<b>Amino acids, peptides etc</b>	<b>22</b>	<b>The organic chemistry of amino acids, peptides and proteins</b>		<b>15</b>
		22.1	The nomenclature of amino acids	
		22.2	The configuration of amino acids	
		22.3	The acid-base properties of amino acids	
		22.4	The isoelectric point	
		22.5	Separation of amino acids (only the ninhydrin reaction)	
		22.6	The synthesis of Amino acids	
		22.7	The resolution of racemic mixtures of amino acids	
		22.8	Peptide bonds and disulfide bonds	
		22.10	The strategy of peptide bond synthesis: N-protection and C-activation	
		22.11	Automated peptide synthesis	
		22.13	How to determine the primary structure of a polypeptide or a protein	
		<b>Lipids, terpenoids etc</b>	<b>16</b>	
16.4	Fatty acids are long-chain carboxylic acids			
16.13	Fats and oils are triglycerides			
<b>25</b>	<b>The organic chemistry of metabolic pathways - Terpene biosynthesis</b>		<b>4</b>	

		25.16	Terpenes contain carbon atoms in multiples of five	
		25.17	How terpenes are synthesized	
		25.18	How Nature synthesizes cholesterol	
<b>Nucleic acids</b>	<b>26</b>	<b>The chemistry of the nucleic acids</b>		<b>8</b>
		26.1	Nucleosides and nucleotides	
		26.3	Nucleic acids are composed of nucleotide subunits	
		26.13	The polymerase chain reaction	
<b>Pericyclic reactions</b>	<b>8</b>	<b>Delocalized Electrons and Their Effect on Stability, pKa, and the Products of a Reaction</b>		<b>6</b>
		8.19	The Diels-Alder reaction is a 1,4-addition reaction	
		8.20	Retrosynthetic analysis of the Diels-Alder reaction	
	<b>28</b>	<b>Pericyclic reaction (the whole chapt.)</b>		<b>27</b>
<b>Total No. of pages*</b>				<b>191</b>

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