Sacramento City College
CHEM 309: General, Organic and Biochemistry
Prof. Dianne Bennett
Agenda (Fall) • Agenda (Spring) • Homework Problems

1. Chapter 2: The Classical Wave Equation
2. 2.1: The One-Dimensional Wave Equation
3. 2.2: The Method of Separation of Variables
4. 2.3: Oscillatory Solutions to Differential Equations
5. 2.4: The General Solution is a Superposition of Normal Modes
6. 2.5: A Vibrating Membrane
7. 2.E: The Classical Wave Equation (Exercises)

• Homework Solutions
1. Chapter 11: Computational Quantum Chemistry
2. 11.1: Gaussian Basis Sets
3. 11.2: Extended Basis Sets
4. 11.3: Orbital Polarization Terms in Basis Sets
5. 11.4: The Ground-State Energy of H2H2
6. 11.5: Quantum Calculations
7. 11.E: Computational Quantum Chemistry (Exercises)

Chapters
1. Chapter 12: Group Theory: The Exploitation of Symmetry
2. 12.1: The Exploitation of Symmetry
3. 12.2: Symmetry Elements
4. 12.3: Symmetry Operations Define Groups
5. 12.4: Symmetry Operations as Matrices
6. 12.5: The C3VC3V Point Group
7. 12.6: Character Tables
8. 12.7: Characters of Irreducible Representations
9. 12.8: Using Symmetry to Solve Secular Determinants
10. 12.9: Generating Operators
11. 12.E: Group Theory: The Exploitation of Symmetry (Exercises)

• Video Tutorials
1. Chapter 13: Molecular Spectroscopy
2. 13.1: The Electromagnetic Spectrum
ALL questions listed must be answered to earn credit for completing the text homework. Yes, even the Additional Exercises if applicable.

**Carbohydrate Structure**

(01) Study the following Fischer projections to answer the questions below.

![Galactose and Mannose Fischer projections]

a. Is galactose a D-sugar or an L-sugar?
b. Is mannose a D-sugar or an L-sugar?
c. Choose either one, and sketch it as it would appear if it was an L-sugar.
d. Are these two carbohydrates enantiomers? If not, in how many places do they differ?
e. What is the term to describe the relationship between galactose and mannose?
(02) Are any of the following carbohydrates L-sugars? What makes something an L-sugar as opposed to a D-sugar? Rewrite each structure into an L-sugar if they are not already in that conformation.

![Carbohydrate Structures](image)

(03) Which carbon is considered the anomeric carbon? How do you distinguish between the alpha and beta types of anomers?

(04) Study these Haworth projections to answer the following for each of them.

![Haworth Projections](image)

a. Is it a furanose or a pyranose?
b. Is it an alpha or beta anomer?c. Circle the anomeric carbon.

(05) Examine the structure of this Fischer projection of D-gulose.

![Fischer Projection](image)

a. Number each carbon from 1 to 6. What number is the anomeric carbon?
b. Circle the –OH group that determines whether it is a D- or L-sugar.
c. Sketch the structure of L-gulose for comparison. Are the two versions of gulose enantiomers of one another or diastereomers?
d. Now sketch the structure of D-glucose for comparison. Are D-gulose and D-glucose enantiomers or diastereomers?
(06) Examine the following Haworth projections to answer the questions below.

![Haworth projections of two compounds](image)

a. Circle each anomeric carbon
b. Which of the two is the alpha anomer and which is the beta anomer?
c. Are these structures considered enantiomers or diastereomers?
d. Are these monosaccharides reducing sugars? Explain.
e. Can you convert the alpha anomer to a beta anomer? Explain.

(07) Consult your text and notes for the structure of lactose. Lactose utilizes a beta-1,4 linkage to form a disaccharide. Sketch a hypothetical disaccharide where it instead links the two monosaccharides that form lactose via an alpha-1,6 formation.

(08) Some people cannot digest the disaccharide lactose. The term for this is known as lactose intolerance. Lactose is shown below. Answer the following questions.

![Structure of lactose](image)

a. What is the name of the enzyme that would be required for someone to be able to digest lactose?
b. Classify lactose as a mono-, di-, oligo-, or polysaccharide.
c. Label anomeric carbons by circling them. Is lactose a reducing sugar?
d. Draw an arrow pointing to the glycosidic bond. Is the glycosidic bond connected to both anomeric carbons?
e. Classify the glycosidic bonds using the alpha or beta-(#, #) format.
f. If the glycosidic bond is hydrolyzed, what are the names of the monosaccharides produced. Remember to include the alpha or beta classification for the anomeric carbon.