Third Hour Exam (Chapters 5 and 9)

All answers should be written on the exam in the spaces provided. Clearly indicate your answers in the spaces provided; if I have to guess as to what or where your answer is, it's wrong. Where applicable, outline the logic or mystical principle you used to arrive at your answer, as partial credit may be awarded for correct approaches.

You are strongly advised to read through the entire exam before beginning.

(1). 4 pts..............................
(2). 4 pts..............................
(3). 8 pts..............................
(4). 6 pts..............................
(5).16 pts..............................
(6).10 pts..............................
(7).21 pts..............................
(8).16 pts..............................
(9). 6 pts..............................
(10). 8 pts..............................

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TOTAL (99 pts)......................

Percentage …………........
1. [4 pts] Mevacor is used clinically to lower serum cholesterol levels. How many chiral centers does Mevacor have? Circle the chiral carbons.

2. [4 pts] Draw a Fischer Projection for the following chiral, tetrahedral carbon:

3. [8 pts] Stereochemistry Questions: Assign R or S to the following molecules:

   (a) 

   (b) 

4. [6 pts] A solution of an unknown compound X (3.0 g of X per 20 mL), when placed in a polarimeter tube 2.0 dm long, was found to have an observed rotation of $-1.8^\circ$. What is the specific rotation of X?
5. [16 pts] Shown below are five compounds whose molecular formula is C₆H₁₂. Base the answers to the questions below on these five structures.

A  B  C  D  E

a. List two isomers that would be constitutional isomers of each other

b. List two isomers that would be diastereomers of each other

c. List two isomers that would be meso compounds.

d. Isomer A has an optical rotation of +35°. What is the optical rotation of isomer B?

e. What is the optical rotation of isomer D?

6. [10 pts] Two stereoisomers are obtained from the reaction of HBr with (3S, 4S)-4-bromo-3-methyl-1-pentene.

a. [4 pts] Draw the structures of the two stereoisomers that form, showing stereochemistry of the new chiral center.

\[
\begin{align*}
\text{Br} & \quad \text{HBr} \\
\end{align*}
\]

b. [2 pts] What is the relationship between these two stereoisomers?

- Same
- Enantiomers
- Diastereomers
- Meso compounds

c. [4 pts] One of the stereoisomers is not optically active. Circle the optically inactive compound and explain why it is optically inactive.
7. [21 pts] Draw the structure of the expected product(s) or reagent for each of the following reactions, as required. Indicate the stereochemistry of the products where appropriate.

(a) 
\[\text{alkyne} \rightarrow \text{alkene} \] 2 equiv. HCl

(b) 
\[\text{alkyne} \rightarrow \text{halide} \] 1 equiv. Br₂

(c) 
\[\text{alkyne} \rightarrow \text{alkene} \] 1. disiamylborane 
2. NaOH, H₂O₂

(d) 
\[\text{alkene} \rightarrow \text{aldehyde} \] 1. O₃ 
2. Zn, H₃O⁺

(e) 
\[\text{alkyne} \rightarrow \text{aldehyde} \]

(f) 
\[\text{alkyne} \rightarrow \text{ketone} \]

(g) 
\[\text{alkyne} \rightarrow \text{alkene} \] H₂, Pd/C
8. [16 pts] Synthesis: Devise a short sequence of reactions for the construction of the following products. Write the required reagents on each arrow and draw the intermediate product(s) that will form in your sequence to receive full credit.
a. [6 pts]

b. [10 pts]

9. [6 pts] Name the following compounds according to IUPAC nomenclature:
10. (16 pts) Short Answers- Choose 4 of the following 6 questions.

a. Explain how R and S are related to (+) and (-).

b. Define the term: enantiomers

c. The following statement is false. Explain why.

   “Any molecule containing a stereocenter must be chiral”.

d. Explain why the pKa of the proton on a terminal alkyne is 25 but the proton on a terminal alkene is 45.