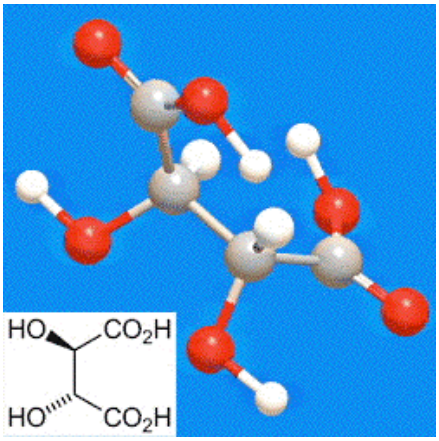
Chemistry 124 Third Examination Name _____

November 14, 2008

The exam budgets 50 minutes, but you may have 60 minutes to finish it. Good answers can fit in the space provided.

1. Over the past three and a half years the American Chemical Society has honored 181 different compounds as "Molecule of the Week." This week (November 10, 2008) it belatedly honored L-(+)-Tartaric acid (shown in the figures to the right).



A) (1.5 min) Give common names for **three *other*** forms (or configurational isomers) of tartaric acid with sharp melting points.

B) (2 min) ***Write CIP priority*** numbers (1 is high) on the substituents of ***one*** of the stereogenic carbons in the ball-and-stick formula and ***label*** it as R or S.

C) (1.5 min) ***Explain*** whether L-(+)-Tartaric acid should be denoted *d*-, or *l*-, or whether the designation is uncertain?

D) (2 min) In the left margin ***draw the Fischer Projection*** of L-(+)-Tartaric acid.

2. (5 min) Briefly describe **two different ways** to separate 50:50 mixtures of enantiomers. Try to be specific. The methods must **NOT** involve the type of conglomerate used by Pasteur in his 1848 preparation of "unnatural" tartaric acid.

3. Joseph Louis Gay-Lussac was involved in a number of important chemical developments at the beginning of the 19th Century that are more often associated with others.

A) (2 min) Draw clear lines to match each of Gay-Lussac's activities in the left column with one of the important contributors in the right column. One line already drawn to help you get started.

Work by Gay-Lussac	Contributions by Others
Making a balloon ascent with J. B. Biot	Amodeo Avogadro's Law
Analyzing water and ammonia	Friedrich Wöhler's "Isomerism"
Advising research on Cyanate salts	Humphry Davy's discovery of New Elements
Working with $NaClO_3$	John Dalton's Atomic Theory
Working on "Big Science"	Organic Analysis by J.-J. Berzelius

B) (5 min) Choose **two of the lines** drawn in part A and write a few explanatory sentences about the connection between Gay-Lussac's contribution and the related contribution by someone else.

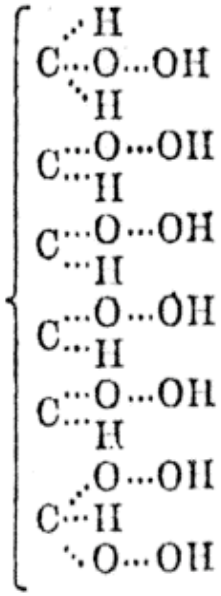
4. (3 min) Explain very briefly why the device shown on this woodcarving in the SCL Library was revolutionary for 19th Century organic chemistry

5. The dualistic radical theory of Wöhler, Liebig, and Berzelius was founded in part on the reaction between benzaldehyde ($C_6H_5C(=O)-H$) and elemental chlorine (Cl-Cl).

A) (3 min) Write a ***balanced equation*** showing the composition of starting materials and products for this reaction, and ***explain*** how it might cast doubt on the theory of dualism.

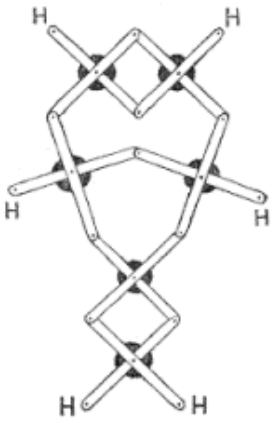
B) (6 min) Draw a series of steps with ***curved arrows*** to show how the transformation actually *did* involve free radicals.

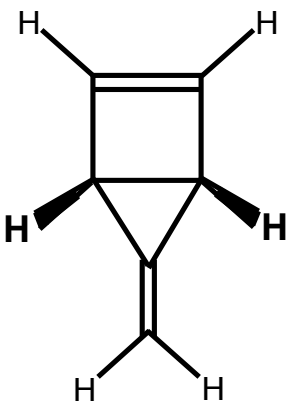
6. (8 min) Suppose a friend of yours who took organic chemistry somewhere else ridiculed this structural formula for glucose. What would you say to ***explain*** that his ***criticism is naïve*** and that in fact this formula is not only in its own terms ***correct*** but represents one of the ***most important advances*** ever in organic chemistry?

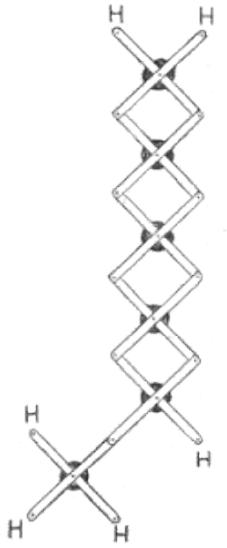


7. (4 min) Draw "3-isopropyl-5,5-dimethyloctane" and give its proper systematic (IUPAC) name.

8. Below are shown two of Dewar's 2-dimensional models for possible constitutions for benzene, and a 3-dimensional structural formula for the first one.







A) (2 min) In the open space above draw an analogous 3-dimensional structural formula for the second Dewar model. Use wedges and/or dashed bonds as necessary to show the configuration unambiguously. (Do not worry about conformation.)

B) (5 min) Explain how counting stereoisomers of monosubstituted versions of these molecules might allow discriminating between the 3-dimensional isomers in Question A.