My parents call me ____________________________

Directions: This examination is in two parts. PART I consists of 8 multiple choice questions (each worth 4 points) Circle the correct answer. PART II (68 pts) involves questions of general nature requiring write-up on your part. Be brief, clear and to the point.

GOOD LUCK

RELAX, STAY CALM AND DO YOUR BEST

PART I: MULTIPLE CHOICE QUESTIONS

I. Which of the following molecules are chiral?

1. [Chemical structures]

(a) 1, 3, 5  (b) 3, 5  (c) 1, 3  (d) 1, 2, 4  (e) All are chiral

II. Which molecule(s) is (are) optically inactive?

[Chemical structures]

(a) 1, 2  (b) 2, 3, 4  (c) 1, 3, 4  (d) 1, 3, 5  (e) All are inactive
III. Which of the following molecules is chiral?
(a) (2S, 3S)-2,3-dibromobutane
(b) (2R, 3S)-2,3-dibromobutane
(c) (3R, 4S)-3,4-dinitrohexane
(d) Hexane-1,1-dioic acid
(e) none of these

IV. Pure S-lactic acid (present in milk) has a specific rotation of $+2.6^\circ$. A commercial sample of lactic acid has specific rotation of $+1.3^\circ$. This sample has,
(a) an optical purity of 1.3% and consists of 13% R- and 87% racemic lactic acid.
(b) an optical purity of 50% and consists of 75% R- and 25% S-lactic acid.
(c) an optical purity of 50% and consists of 50% R- and 50% S-lactic acid.
(d) an optical purity of 50% and consists of 25% R- and 75% S-lactic acid.
(e) an optical purity of 2.6% and consists of 26% R- and 74% S-lactic acid.

V. How many stereoisomers are possible for 2, 3, 4-Hexanetriamine?
(a) 3  (b) 4  (c) 6  (d) 8  (e) 12

VI. Which of the following statement(s) is (are) not correct?
(i) All optically active compounds do not have chiral center(s) present.
(ii) Diastereomers have identical properties.
(iii) Erythro and threo isomers are not mirror images.
(iv) Biphenyl compounds are optically active.
(a) i and iv  (b) i, ii, and iii  (c) i and iii  (d) None of these  (e) ii and iii

VII. The drawings: 
\[
\begin{align*}
\text{Me} & \\
\text{Me} \\
\end{align*}
\]
are examples of:
(a) Structural isomers
(b) Geometrical isomers
(c) Resonance
(d) Enantiomers
(e) Diastereomers
VIII. Which of the following statement(s) is (are) correct?

(i) Conformers are isolable. ( )
(ii) All configurational isomers involve chiral centers. ( )
(iii) Resonance Energy is the actual energy of the molecule. ( )
(iv) The number of chiral isomers is always equal to \( 2^n \) where \( n \) is equal to the number of chiral centers.
(v) Meso compounds can be resolved.

(a) i and ii  (b) i, iii, and iv  (c) i, iii and v  (d) ii and v  (e) none is correct.

PART II:

I. Draw ALL the isomeric structures for each of the following. Circle those which are optically active and list the cause for optical activity or lack of it. (20 pts.)

1. 1,7,7-Trimethyl-6-hydroxy bicyclo [2.2.1] heptan-2-one.

2. 2-Amino-3-pentenoic acid.
II. Explain the following observations briefly, but clearly. (15 pts.)

(1) Van't Hoff's Rule fails when identical chiral centers are present?

(2) Does the change in the sign of rotation of an optically active molecule necessarily implies change of configuration?

(3) Why are all the bonds in benzene exactly identical?
Using Newman’s projection, draw erythro and threo isomers of 3,4-dichlorohexane-1,6-dioic acid. Label each isomer as erythro or threo, and predict the optical activity of each. (10 pts)

IV. Specify R, S; or E, Z configuration for all stereoechemical features in each of the following compound. (12 pts.)

1. 

2. 

CH$_2$OH
H
HO
H
CHO
Write all stereomeric 1,2-dihydroxyclobutanes. If a mixture consisting of one mole each of all the isomers is fractionally distilled, how many fractions would be obtained? Which fraction(s), if any, will be optically active? (10 pts)