Chemistry 334

Final Examination

May 22, 2000 Professor Charonnat

Name: _____

Be certain that your examination contains eleven (11) pages including this cover page.

Put your name on each page of this examination booklet.

By putting your name on this examination booklet, you agree to abide by
California State University, Northridge policies of academic honesty and integrity.

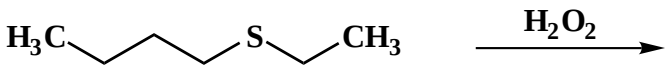
Molecular models are allowed for this examination. Calculators are unnecessary and are not allowed.

Name: _____

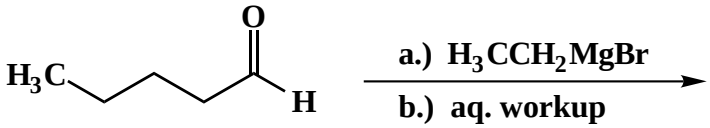
1. (50 points)

For each of the following ten (10) questions, draw the expected major organic product.
If relevant, clearly specify the relative and/or absolute stereochemistry of the product.

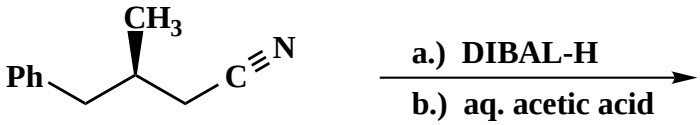
A.



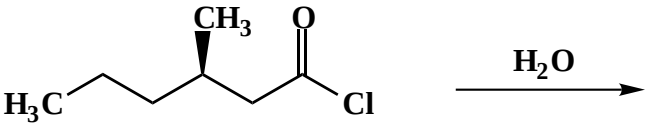
B.



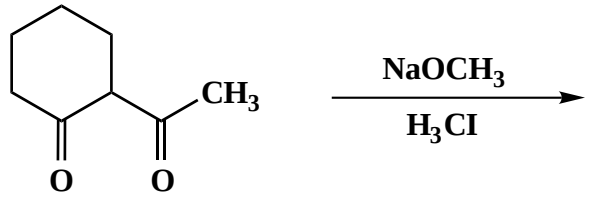
C.



D.



E.

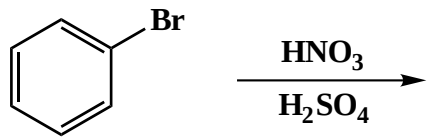


(racemic)

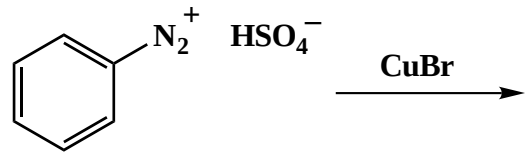
Name: _____

1. (continued)

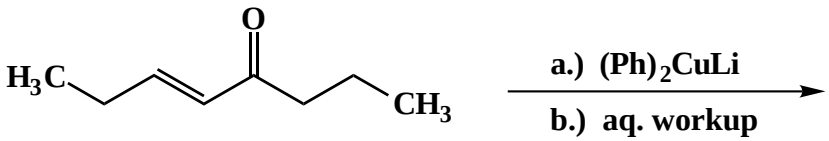
F.



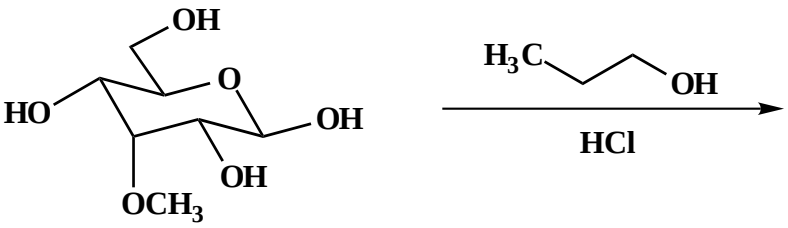
G.



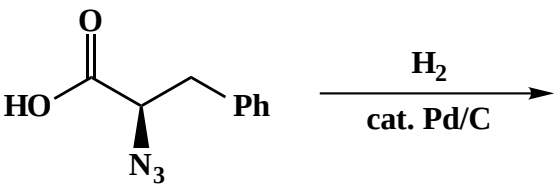
H.



I.



J.

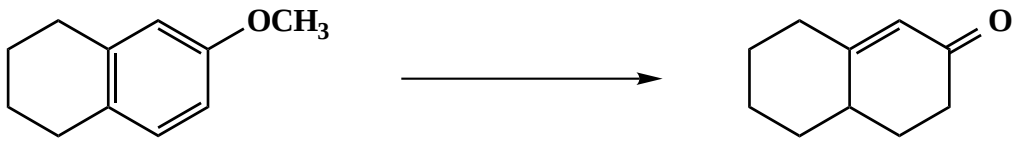


Name: _____

2. (25 points)

For each of the following five (5) questions, draw the specific reagent(s) necessary to effect the transformation shown. If more than one reaction is involved in an answer, be certain to distinguish the individual steps clearly.

A.

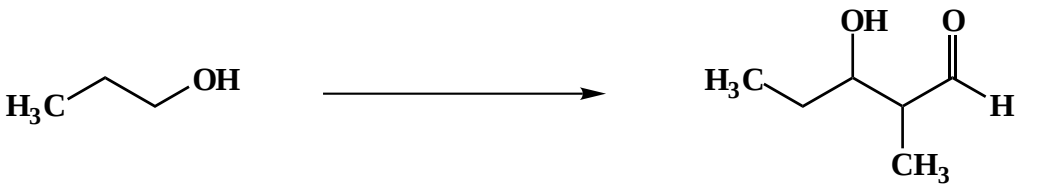


(racemic)

B.

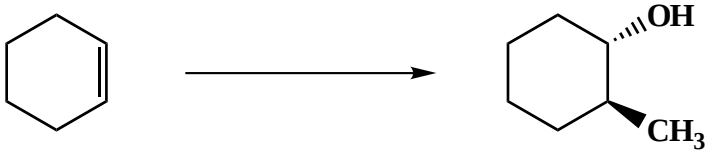
(racemic)

C.



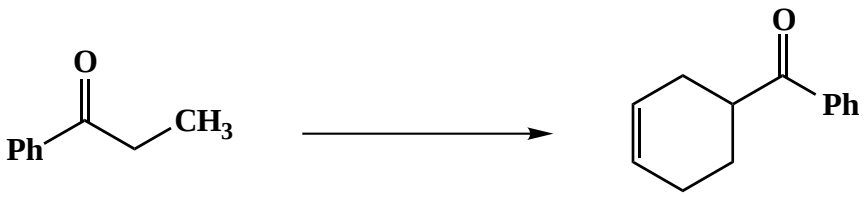
(mixture of diastereomers)

D.



(racemic)

E.



(racemic)

Name: _____

3. (25 points)

For each of the following five (5) questions, circle the number that corresponds to the correct answer.

A. Which of the following cannot be optically active?

1. a primary amine
2. a secondary amine
3. a tertiary amine

B. The conversion of an imine to the corresponding amine involves

1. an oxidation
2. a reduction
3. a hydrolysis

C. At very high pH, an α-amino acid exists as an

1. ammonium carboxylic acid
2. ammonium carboxylate
3. amino carboxylate

D. Evans' synthesis of optically active α-amino acids involves which chiral species as the template?

1. an α-amino acid derivative
2. a terpene derivative
3. a carbohydrate derivative

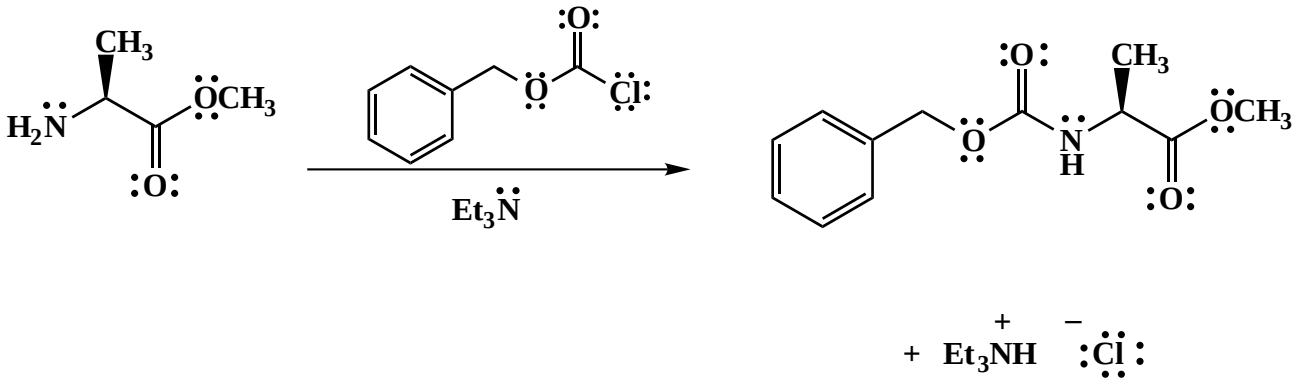
E. Prostaglandins are derived from

1. fatty acids
2. carbohydrates
3. steroids

Name: _____

4. (15 points)

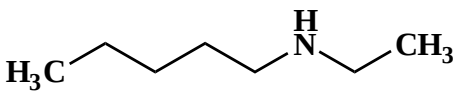
An alternative amine protecting group is the carbobenzyloxy (Cbz) group. It is prepared by the reaction of an amine with benzyl chloroformate. A specific example of its use is shown below. Draw the mechanism of this reaction, using the curved-arrow notation to indicate the reorganization of electron density. Show all intermediates, unshared electrons, formal charges and countercharges.



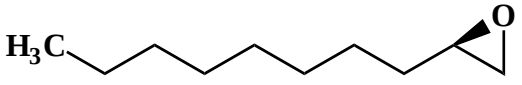
5. (20 points)

Use IUPAC nomenclature to write the systematic names of the following two (2) compounds.

A.



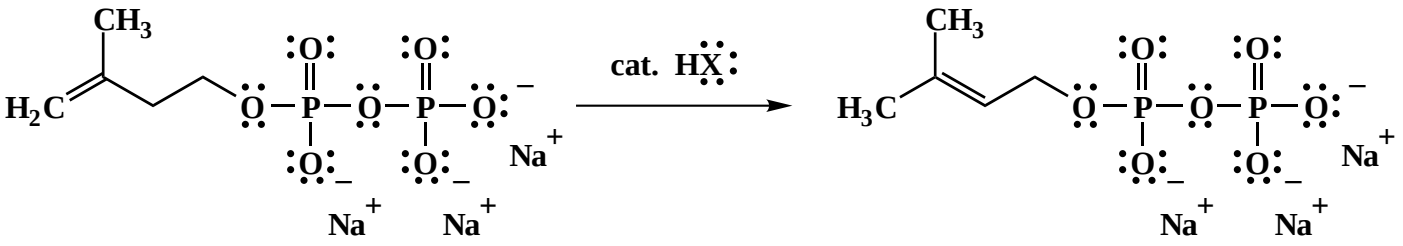
B.



Name: _____

6. (10 points)

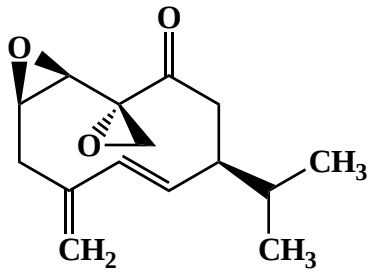
The enzyme, isomerase, catalyzes the isomerization of isopentenyl pyrophosphate to γ,γ'-dimethylallyl pyrophosphate. In principle, this transformation could also be accomplished with an acid, HX. Draw the mechanism of this hypothetical reaction, using the curved-arrow notation to indicate the reorganization of electron density. Show all intermediates and denote all unshared electrons, formal charges and countercharges.



isopentenyl pyrophosphate **γ,γ'-dimethylallyl pyrophosphate**

7. (10 points)

Circle the "isoprene" units in the following terpene. Clearly label the head (h) and tail (t) of each "isoprene" unit.



periplanone B

Name:_____

8. (20 points)

Draw the structure of a specific example for each of the following ten (10) categories.

A. any reducing carbohydrate:

B. any nonreducing carbohydrate:

C. any addition polymer:

D. any condensation polymer:

E. any naturally-occurring, acidic α-amino acid:

F. any naturally-occurring, basic α-amino acid:

G. any naturally-occurring, saturated fatty acid:

H. any naturally-occurring, unsaturated fatty acid:

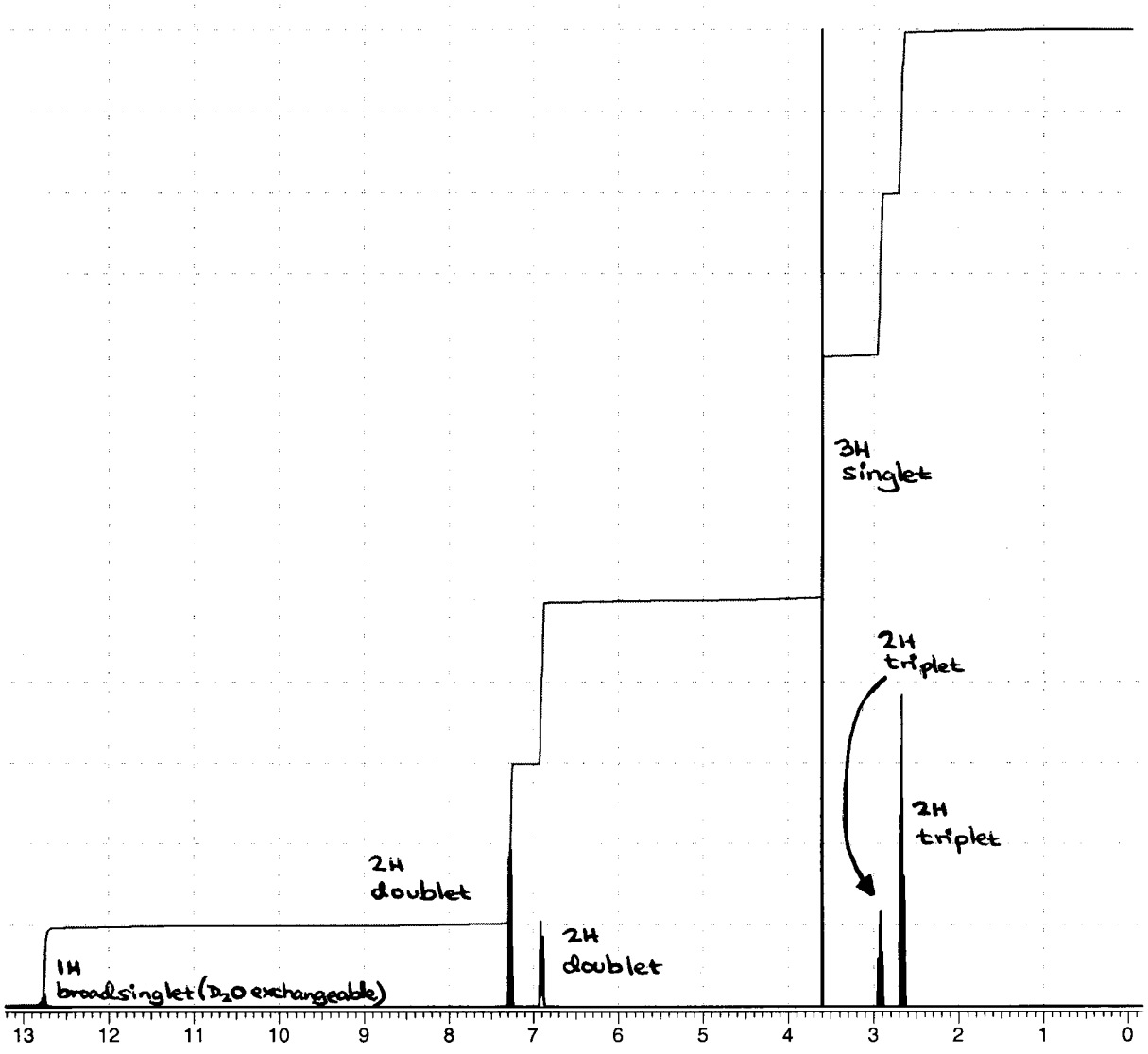
I. any steroid:

J. any naturally-occurring glycerophospholipid

Name:_____

9. (25 points)

The ^{1}H NMR spectrum of compound A ($C_{10}H_{12}O_3$) is shown below. Clearly assign all the resonances and draw the structure of compound A. (A ^{1}H NMR correlation table is included on page 11.)



Name:_____

9. (continued)

^{1}H NMR assignments:

chemical shift (ppm)	**assignment**	**explanation of multiplicity**

structure of compound A:

Congratulations!

1	/50
2	/25
3	/25
4	/15
5	/20
6	/10
7	/10
8	/20
9	/25
Total:	/200

SELECTED ^{1}H NMR CORRELATIONS

structural type	chemical shift range (ppm)
cyclopropyl	0.0 - 0.9
RNH$_2$ R$_2$NH	0.5 - 5.0 [a]
—CH$_3$ (saturated)	0.7 - 1.3
H$_3$C- C- C—X (X = halogen, O, N, carbonyl)	0.9 - 1.2
—CH$_2$ (saturated)	1.2 - 1.3
—CH (saturated)	1.4 - 1.6
H$_3$C- C—X (X = halogen, O, N, carbonyl)	1.0 - 2.0
ROH	1.0 - 5.0 [a]
H$_3$C, C=C / \	1.6 - 1.9
H$_3$C-C≡C—	1.8 - 2.2
H$_3$C with C=O	1.9 - 2.6
H$_3$C-Ar	2.1 - 2.6
H$_3$C-N / \	2.1 - 3.0
—C≡C-H (nonconjugated)	2.0 - 2.6
—C≡C-H (conjugated)	2.8 - 3.1
H$_3$C—X (X = halogen, O)	2.6 - 4.4
Ar-NH$_2$ Ar$_2$NH	3.0 - 5.0 [a]
H$_3$C-O—	3.3 - 4.2
ArOH	4.0 - 10.0 [a]
H$_2$C=C / \ (nonconjugated)	4.6 - 5.0
H, C=C / \ (nonconjugated)	5.1 - 5.9
H$_2$C=C / \ (conjugated)	5.3 - 6.3
H, C=C / \ (conjugated)	5.3 - 7.7
ArH	6.0 - 9.5
R with C(=O)H Ar with C(=O)H	9.5 - 10.5
R with C(=O)OH Ar with C(=O)OH	9.7 - 13.2