1) (5 points) For each multiple choice question, pick the most correct answer.
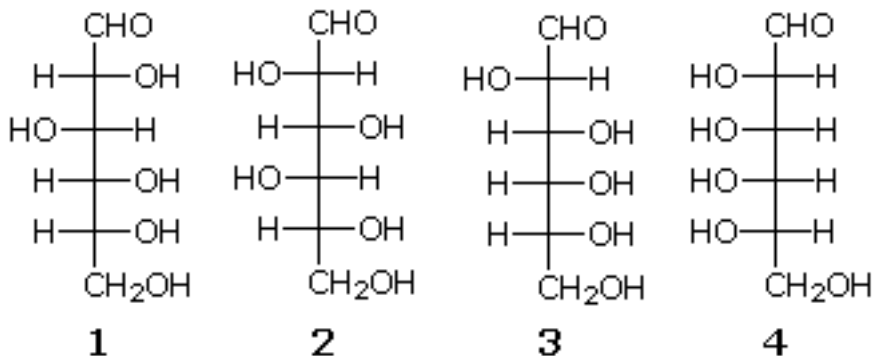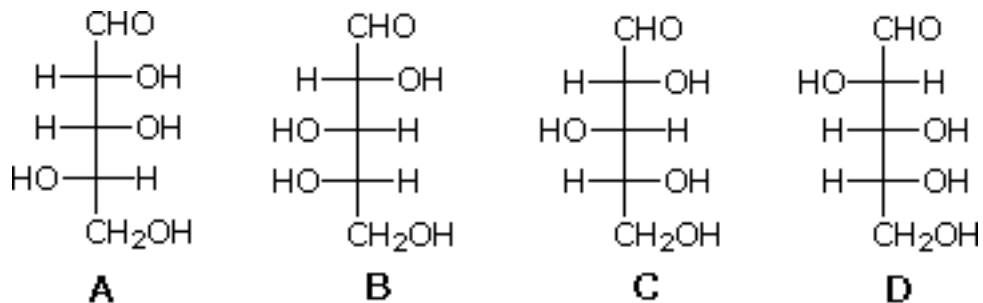
I.   Which two of the following compounds, if any, are epimers?
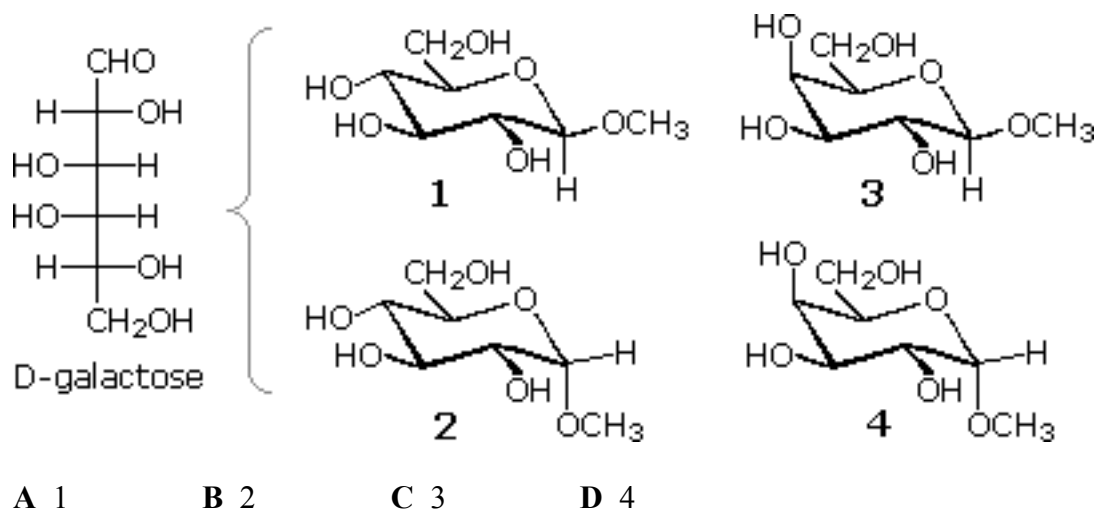

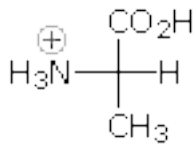
A) 1 and 4
B) 1 and 3
C) 2 and 3
D) 3 and 4

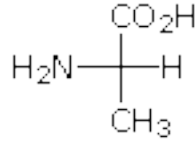II.   (+)-Arabinose is (2R, 3S, 4S)-aldopentose. Which of the following is (+)-arabinose?

III.   Which of the structures **1** through **4** is methyl α-D-galactopyranoside?

A 1   **B** 2   **C** 3   **D** 4
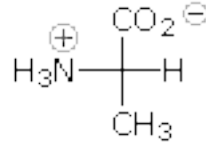
IV.   Which of the following is the major solute species in a solution of alanine at pH=6?
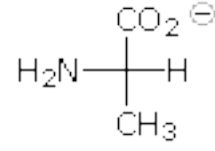
A   B   C   D

V. The amino acid cysteine often forms a disulfide bond with another nearby cysteine. How is this reaction best classified?
A) an addition
B) a substitution
C) an oxidation
D) a reduction

VI. A tripeptide is composed equally of L-valine, L-tyrosine and L-alanine (one molecule of each). How many isomeric tripeptides of this kind may exist?
A) three
B) four
C) six
D) eight

VII. Which if any of the following is a triglyceride?

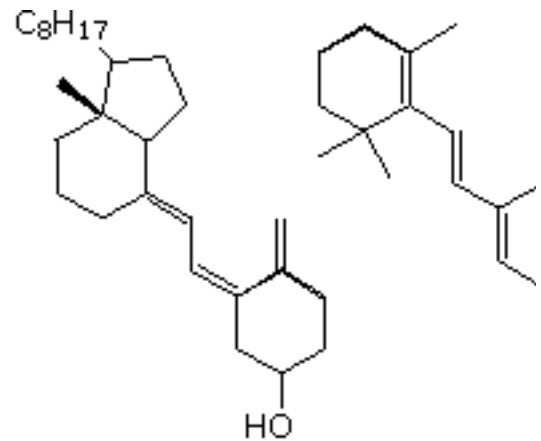VIII. Which of the following would be classified as a prostaglandin?

A   B   C   D
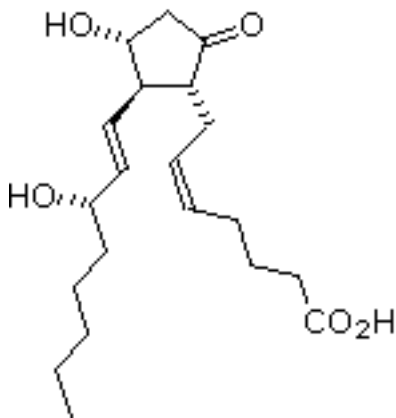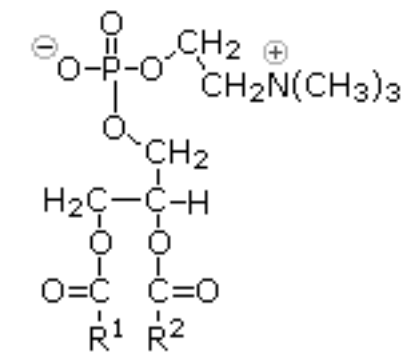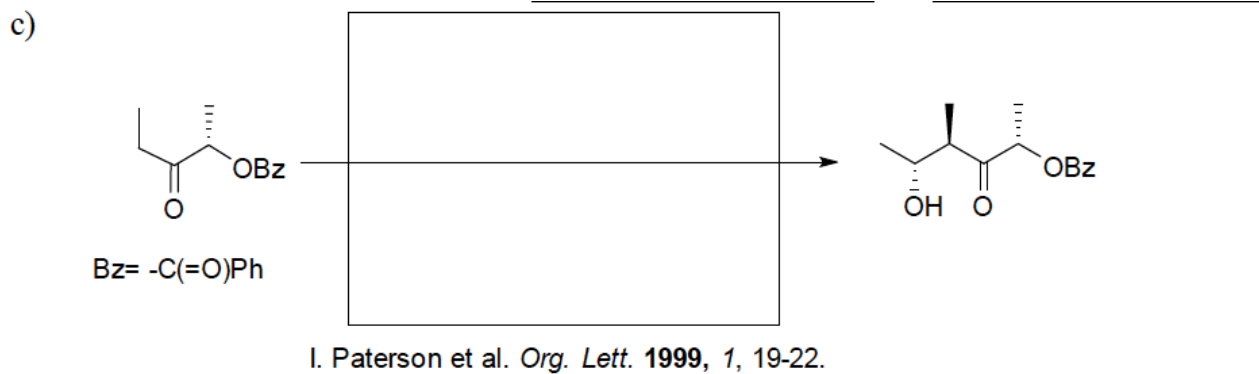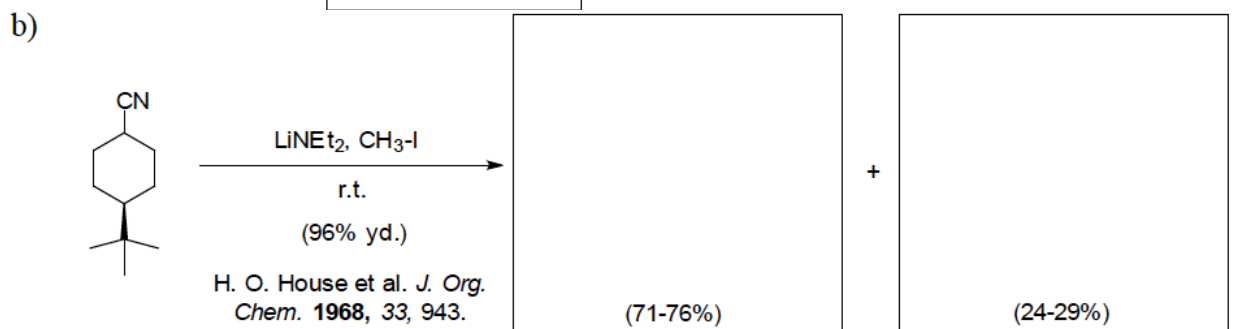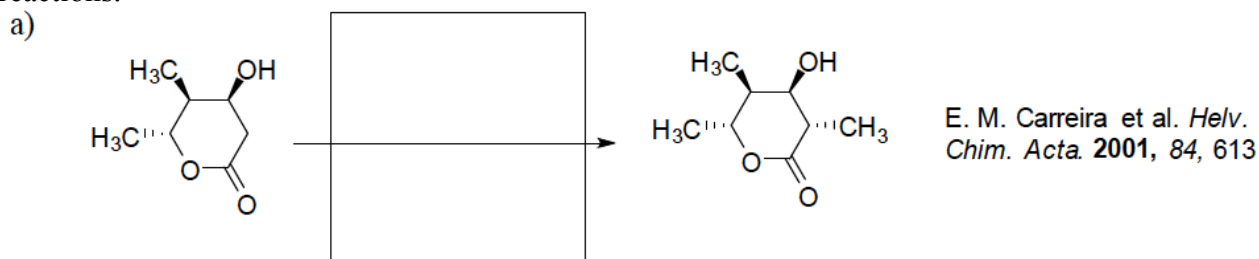
[R = fatty acid group]

IX. Which of the following is a nucleoside?

X.   How many nucleotides are needed to code for a specific amino acid?
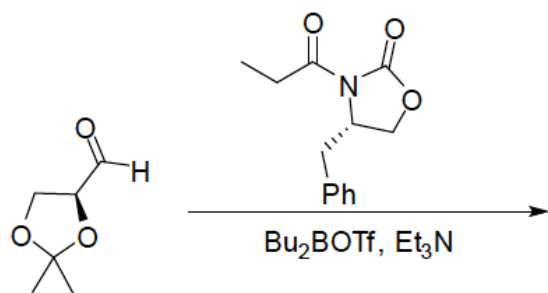   A) one
      B) two
      C) three
      D) four

2) (5 points) It seemed everyone enjoyed this reaction, so let's give it a go. Provide a mechanism for the key C-C bond forming steps in the following reaction. You may abbreviate as necessary.

P. Deslongchamps et al.
Tet. Lett. **1988**, *29*, 6033.
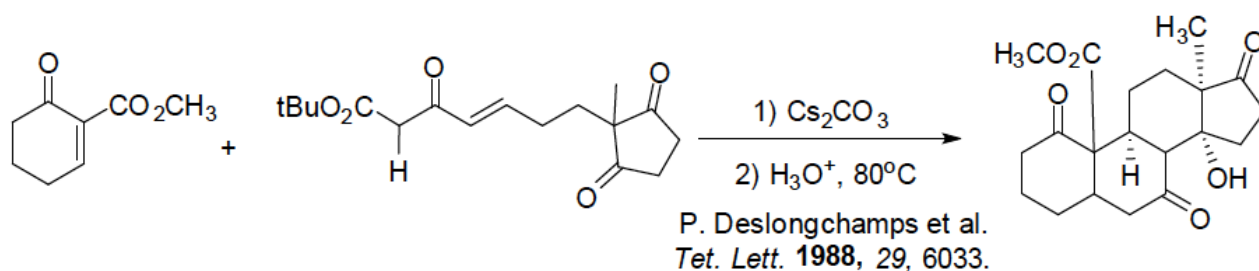
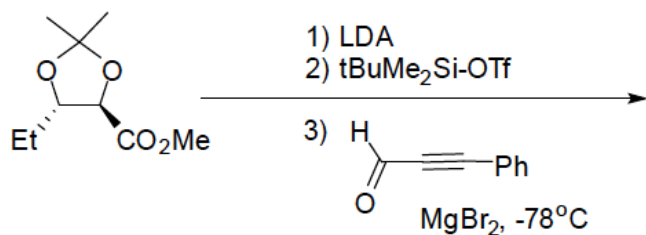**3)** (10 points) Provide the necessary information, products or reagents, to complete the following reactions.

a)

E. M. Carreira et al. *Helv. Chim. Acta* **2001**, *84*, 613

b)

LiNEt₂, CH₃-I

r.t.

(96% yd.)

H. O. House et al. *J. Org. Chem.* **1968**, *33*, 943.

(71-76%)   +   (24-29%)

c)

Bz= -C(=O)Ph

I. Paterson et al. *Org. Lett.* **1999**, *1*, 19-22.

d)

A. B. Smith et al. *Org. Lett.* **1999**, *1*, 1249.

e)

1) LDA
2) tBuMe₂Si-OTf

3) H
   ≡-Ph
   O
   MgBr₂, -78°C

Y. Hayashi et al. *JACS* **2002**, *124*, 12078

f)

1) BuLi, THF, -78°C

2)
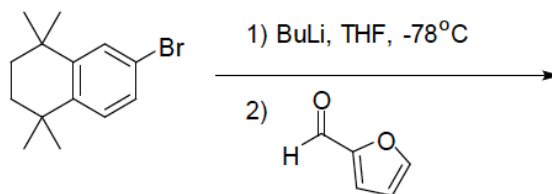
C. D. Haffner et al. *J. Med. Chem.* **2004**, *47*, 2010.

g)

OMe

MeO—SiMe₂t-Bu

1) n-BuLi

2) Br-CH₂CH=CH(CH₃)₂
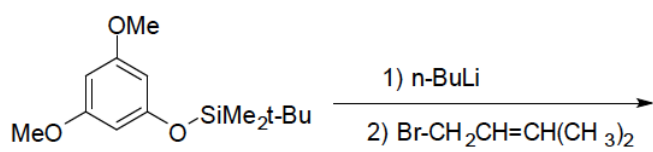
T. L. Shih et al. *JOC* **1987**, *52*, 2029.

h)

C₂H₅MgBr

1) CuBr-S(CH₃)₂, -45°C

2) C₆H₁₃—C≡CH

3) I₂
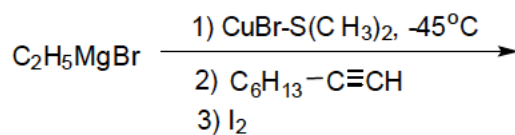
A. B. Levy et al. *JOC* **1978**, *43*, 1279.

i)
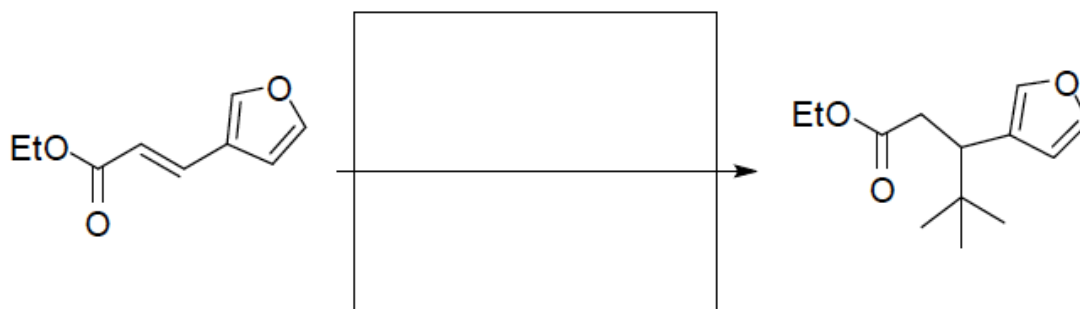
M. T. Crimmins et al. *JACS* **2000**, *122*, 8654.

j)

A. Suzuki et al. *Tet. Lett.* **1979**, 3437
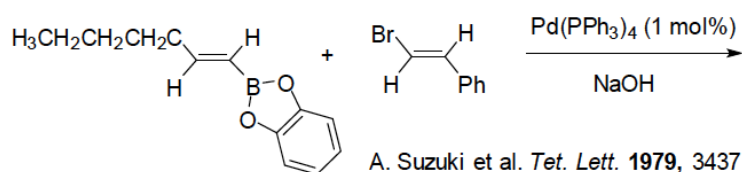
4) (5 points) Identify one reaction on the previous exercize/quenstions that:
a) demonstrates relative stereocontrol
b) demonstrates absolute stereocontrol.
c) illustrates regioselectivity.
d) illustrates chemoselectivity.
e) are name reactions
In the case of multiple parts to a question be as explicit as possible.

5) (5 points) Suggest one- or multi step syntheses of the following compounds starting from pyridine
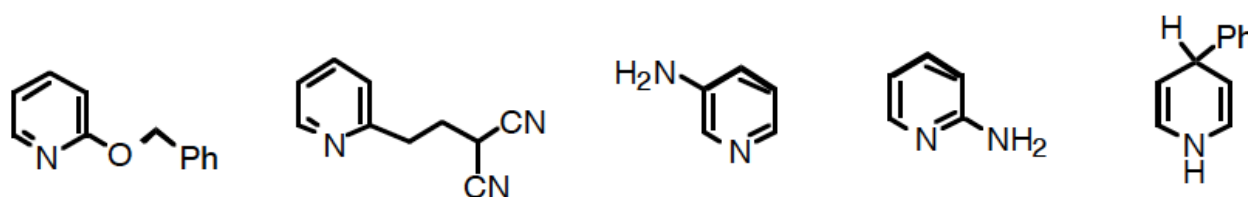
6) (4 points) For ketoprofene depicted below please provide:
1) Retrosynthetic disconnections (to get to the proposed main starting materials);
2) Forward synthesis (with reagents and conditions, NO MECHANISM!)