Chemistry 351
Exam #2
November 14, 2018

Name: _____

Student Number: _____

Section Number: _____

TA: _____

INSTRUCTIONS:

This examination consists of 27 questions on 10 pages. Please make certain that your examination is complete.

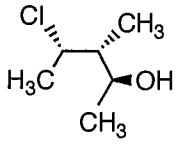
Write your name, student number, and section number **on both the examination and answer sheet. Be certain to bubble in your PID digits on the answer sheet. The absence of any of these identification items will result in the deduction of 2 points from your score.**

Questions 1-22 are each worth 3 points. Point totals for Questions 23-27 are indicated on the exam.

Write your answers to Questions 1- 22 on the enclosed answer sheet. **Write your answer to Questions 23-27 in the space provided on this examination.**

When you complete the examination, insert your answer sheet into your examination and then hand both in on the bench in front of the lecture hall in the spot indicated by your section number.

Questions 1-4 refer to the following molecules: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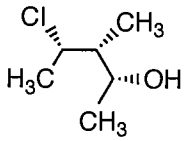
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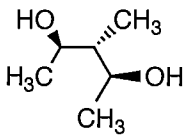
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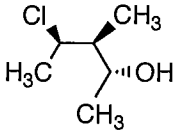
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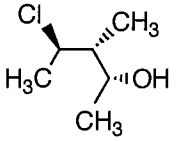
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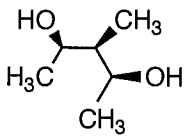
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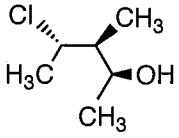
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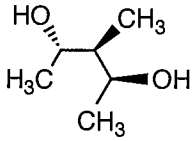
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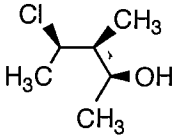
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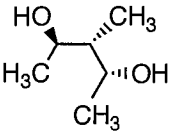

10.

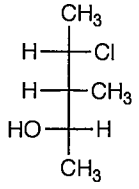
1. Identify the enantiomer of molecule **7**.

a. 1 b. 2 c. 3 d. 4 e. 5 f. 6 g. 7 h. 8 i. 9 j. 10

2. Identify two diastereomers that will NOT rotate plane-polarized light (individually or together).

a. 8,10 b. 6,8 c. 3,8 d. 6,10 e. 3,10 f. 3,6 g. 4,5 h. 1,7 i. 5,7 j. 7,9

3. Identify the substitution products formed when the molecule corresponding to the following Fischer Projection formula is heated in 90% water/10% acetone.

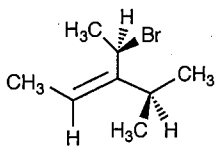


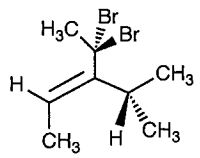
a. 8,10 b. 6,8 c. 3,8 d. 6,10 e. 3,10
f. 3,6 g. 4,5 h. 1,7 i. 5,7 j. 7,9

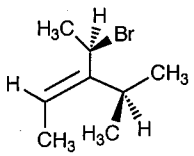
4. Identify ALL of the stereoisomers of molecule **4** that have different melting points relative to molecule **4**:

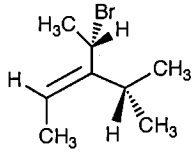
a. 1,5 b. 2,7 c. 5,7 d. 7,9 e. 1,9
f. 2,5,7,9 g. 1,5,7,9 h. 3,6,8 i. 5,7,9 j. 2,5,7

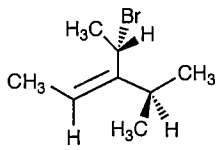
5. Identify which of the following molecules has an *S* stereogenic center and a *Z* double bond:


a.

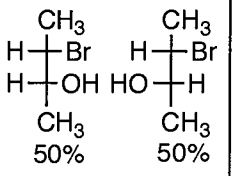
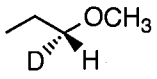
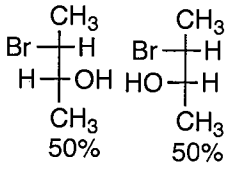
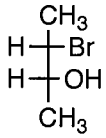
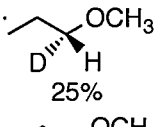
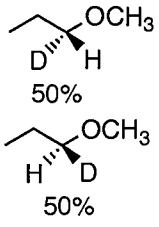
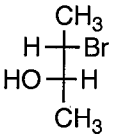
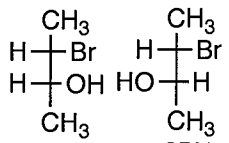
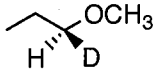
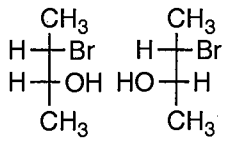

b.


c.

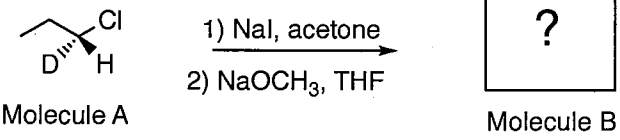

d.


e.

Question 6 and Question 7 are to be answered from the following possibilities:

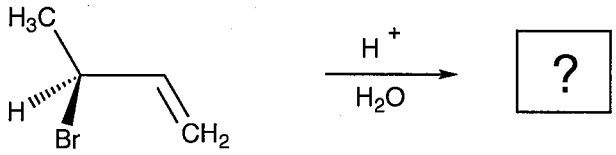
A. 	B.  100%	C. 	D.  100%	E. 
F. 	G.  100%	H. 	I.  100%	J. 

6. Identify the product or products and associated yields formed in the following reaction:

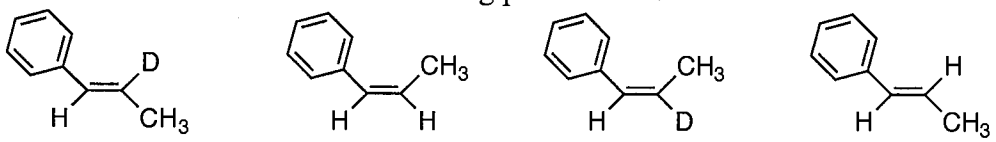


Molecule A Molecule B

7. Identify the product or products and associated yields formed in the following reaction:

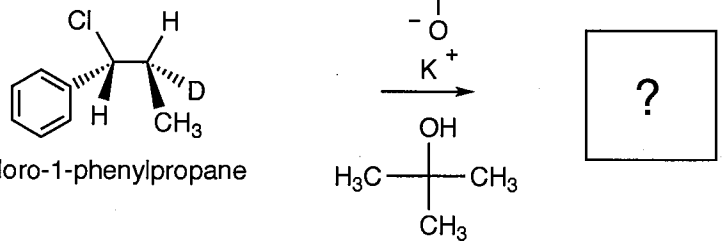


Question 8 is to be answered from the following possibilities:



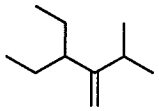
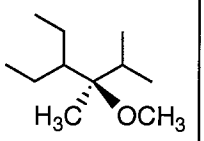
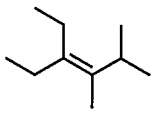
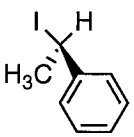
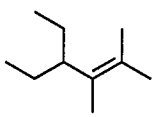
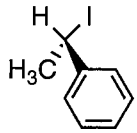
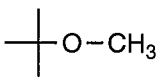
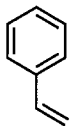
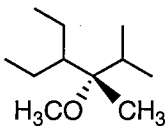
1. 2. 3. 4.

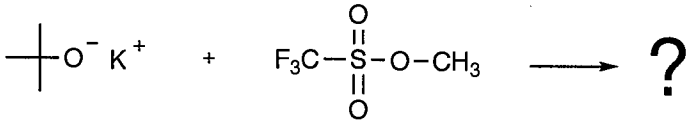
8. Identify the products formed in the following reaction:



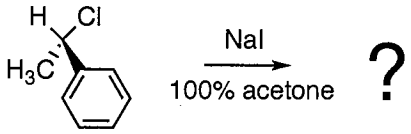
a. 1,2 b. 1,3 c. 1,4 d. 2,3 e. 2,4 f. 3,4

Questions 9-12 are to be answered from the following possibilities:

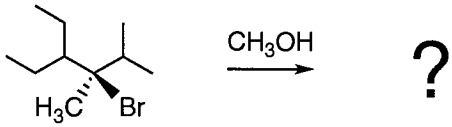
1. 	2. 	3. 	4. 	5. 
6. 	7. 	8. 	9. 	10. No Reaction

9. 

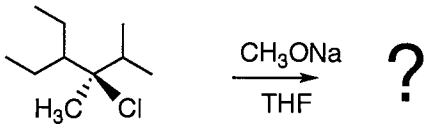
a. 1,3,5 b. 4 c. 1,3,5,9 d. 6 e. 1,2,3,5,9 f. 4,6 g. 7 h. 4,6,8 i. 9 j.10

10. 

a. 1,3,5 b. 4 c. 1,3,5,9 d. 6 e. 1,2,3,5,9 f. 4,6 g. 7 h. 4,6,8 i. 9 j.10

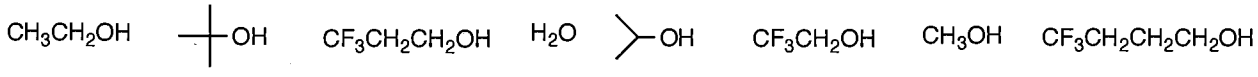
11. 

a. 1,3,5 b. 4 c. 1,3,5,9 d. 6 e. 1,2,3,5,9 f. 4,6 g. 7 h. 4,6,8 i. 9 j.10

12. 

a. 1,3,5 b. 4 c. 1,3,5,9 d. 6 e. 1,2,3,5,9 f. 4,6 g. 7 h. 4,6,8 i. 9 j.10

Question 13 and Question 14 refer to the following alcohols:



1. 2. 3. 4. 5. 6. 7. 8.

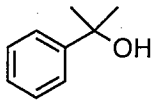
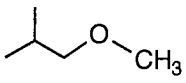
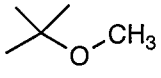
13. The conjugate base of which alcohol is solvated to the least extent in alcoholic solvents?

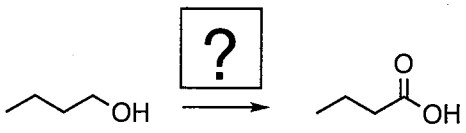
a. 1 b. 2 c. 3 d. 4 e. 5 f. 6 g. 7 h. 8

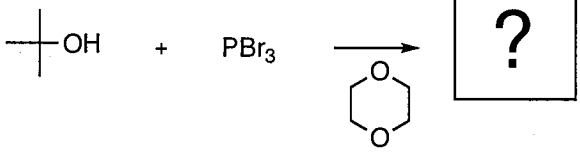
14. The conjugate base of which alcohol is inductively stabilized to the greatest extent?

a. 1 b. 2 c. 3 d. 4 e. 5 f. 6 g. 7 h. 8

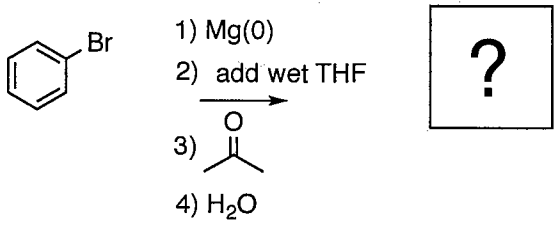
Questions 15-19 are to be answered from the following possibilities:

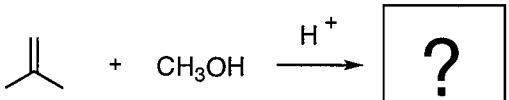
A. PCC	B. Ag(0) O_2	C. 	D. H_3PO_4 HOH 300°C	E.  BrMgOH
F. 	G. 	H. Jones Reagent	I. 	J. No Reaction

15. 

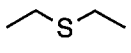
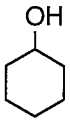
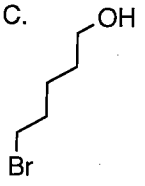
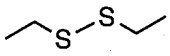
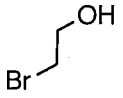
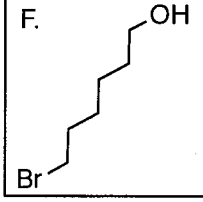
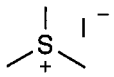
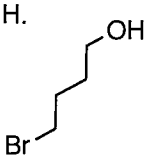
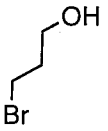
16. 

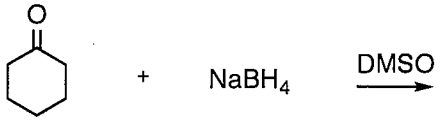
17. 

18. 

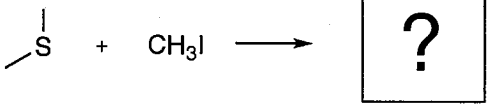
19. 

Questions 20-22 are to be answered from the following possibilities:

A. 	B. 	C. 	D. 	E. 
F. 	G. 	H. 	I. 	J. No Reaction

20. 

21. Choosing from the bromoalcohols listed, identify the bromoalcohol that upon reaction with NaH will undergo intramolecular cyclization the slowest to form a cyclic ether.

22. 

23.

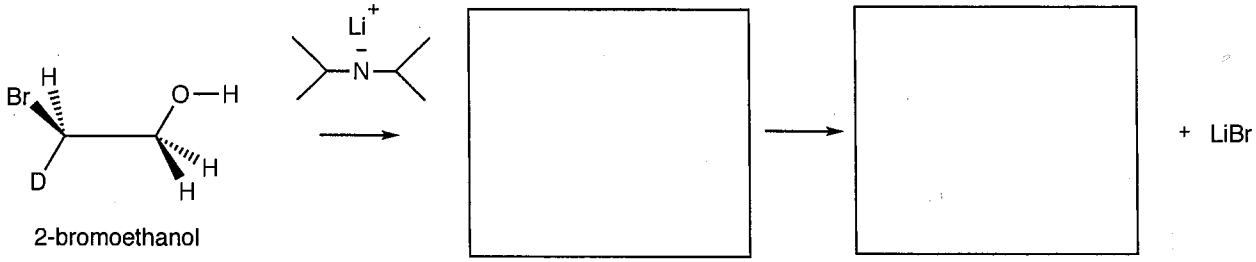
a. (1 pt) Provide **arrows** that show the flow of electrons during **reaction of LDA with 2-bromoethanol** to form the corresponding **Alkoxide Intermediate**.

b. (1 pt) In the labeled box, provide the **structure of the Alkoxide Intermediate conformer** that leads to formation of the Organic Product and LiBr.

c. (1 pt) Provide **arrows** that show the flow of electrons during **reaction of the Alkoxide Intermediate conformer** that leads to the formation of the Organic Product and LiBr.

d. (1 pt) Provide the **structure of the Organic Product** that is formed. Be certain to **show all substituents attached to the stereocenter** in the Organic Product.

e. (1 pt) Label as *R* or *S* the stereocenters in 2-bromoethanol AND the Organic Product.



2-bromoethanol

Alkoxide Intermediate

Organic Product

24.

a. (1 pt) In the labeled box, provide the **structure of Reactive Intermediate A** resulting from reaction of *n*-butanol with thionyl chloride.

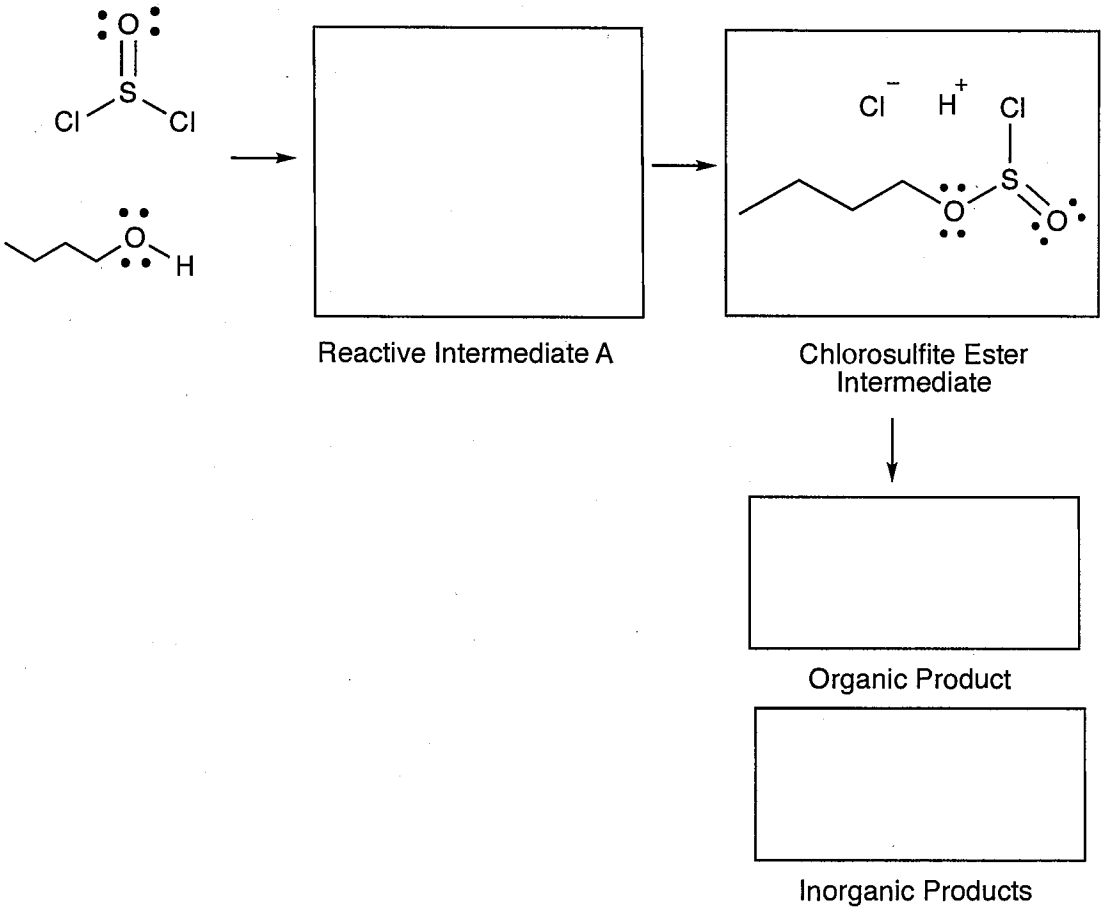
b. (1 pt) Draw **arrows** that show the flow of electrons during **reaction of *n*-butanol with thionyl chloride** to form Reactive Intermediate A.

c. (1 pt) Draw **arrows** that show the flow of electrons during **conversion of Reactive Intermediate A to the Chlorosulfite Ester Intermediate**.

d. (1 pt) In the labeled box, provide the **structure of the Organic Product** that is formed from reaction of *n*-butanol with thionyl chloride.

e. (1 pt) In the labeled box, provide the structures of the **two Inorganic Products** that are formed from reaction of *n*-butanol with thionyl chloride.

f. (1 pt) Draw **arrows** that show the flow of electrons during **conversion of the Chlorosulfite Ester Intermediate to the Organic and Inorganic Products**.



25.

a. (1 pt) In the labeled box, provide the **structure of Reactive Intermediate A** formed from the reaction of neopentyl alcohol with HBr.

b. (1 pt) Draw **arrows** that show the flow of electrons during **reaction of neopentyl alcohol with HBr leading to formation of Reactive Intermediate A.**

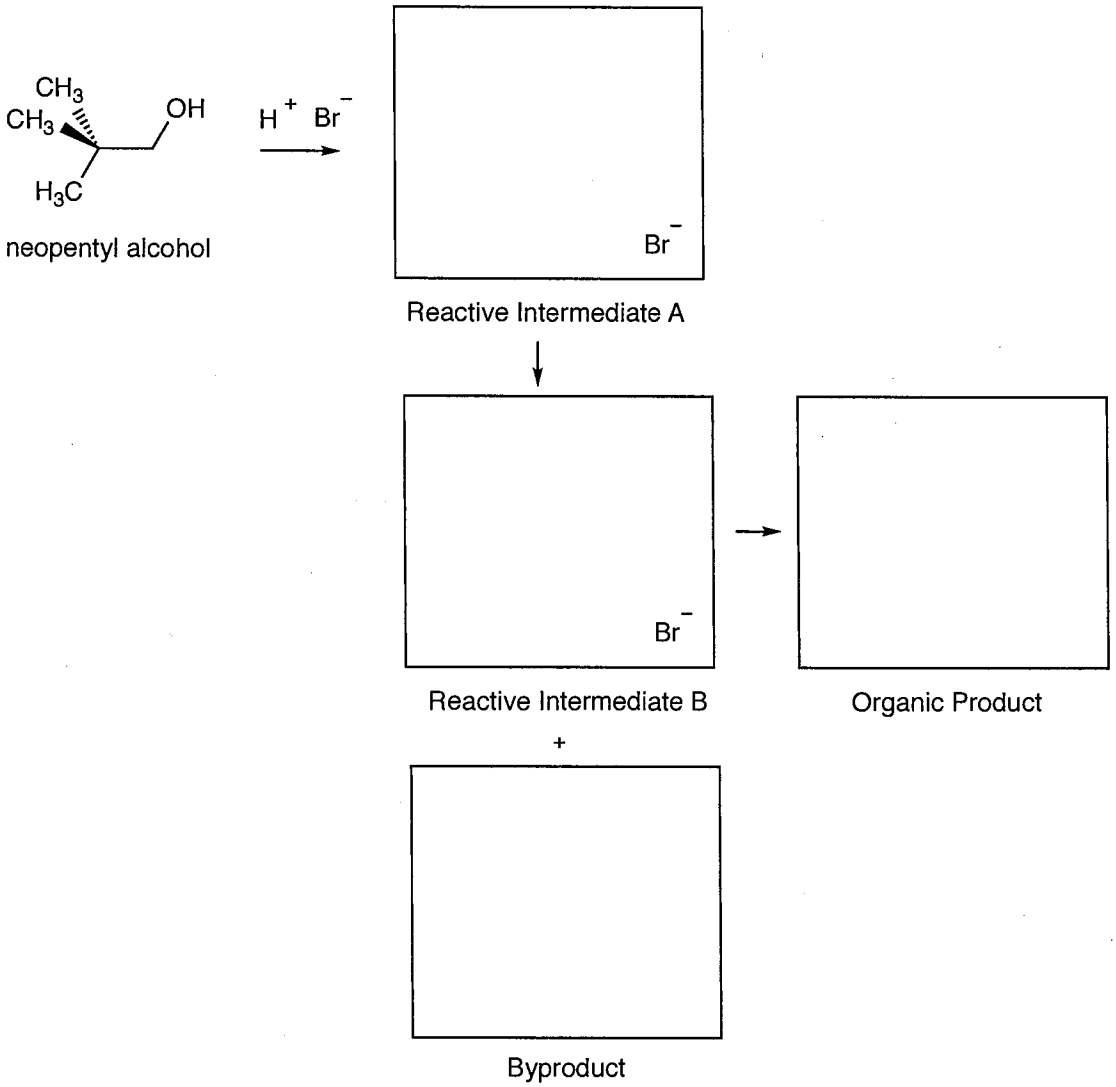
c. (1 pt) Draw **arrows** that show the flow of electrons during **conversion of Reactive Intermediate A to Reactive Intermediate B and the Byproduct**

d. (1 pt) In the labeled box, provide the **structure of Reactive Intermediate B.**

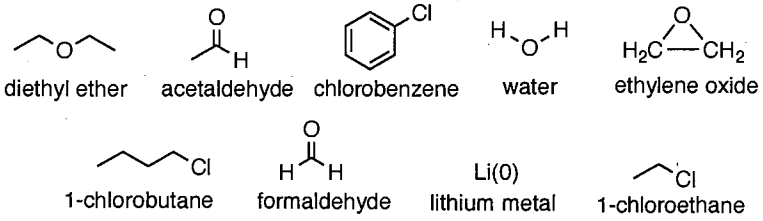
e. (1 pt) In the labeled box, provide the **structure of the Byproduct** formed along with Reactive Intermediate B.

f. (1 pt) Draw **arrows** that show the flow of electrons during the **conversion of Reactive Intermediate B to the Organic Product.**

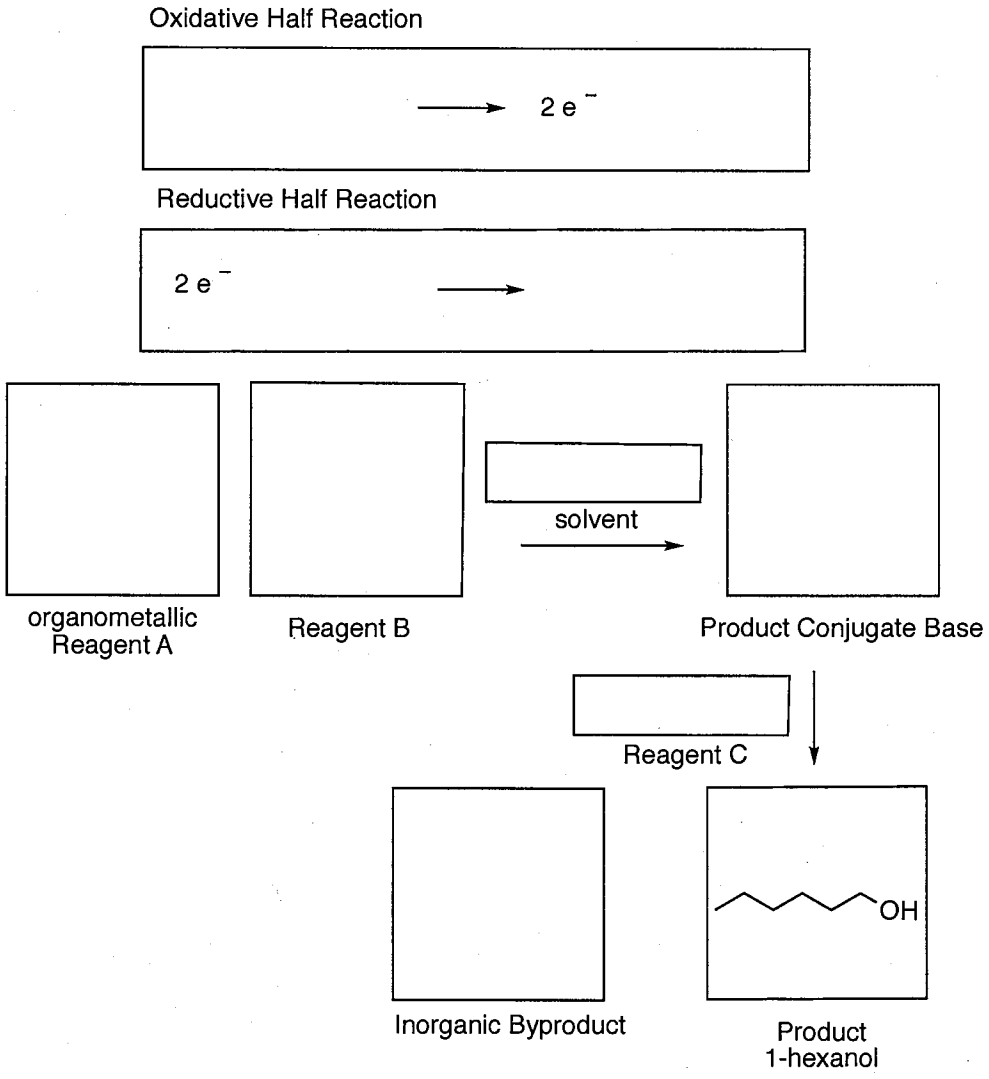
g (1pt) In the labeled box, provide the **structure of the Organic Product** formed from reaction of HBr with neopentyl alcohol.



26. Select from the following reagents to synthesize 1-hexanol:



a. (2 pts) In the labeled boxes below write out the **Oxidative Half Reaction** and the **Reductive Half Reaction** that lead to formation of the organometallic Reagent A that you will need for synthesis of 1-hexanol.
b. (3 pts) In the labeled boxes, provide the structure of **organometallic Reagent A, Reagent B** and the **solvent** required to generate the Conjugate Base of the desired 1-hexanol.
c. (1 pt) **Draw the arrows** that show the flow of electrons during reaction of organometallic Reagent A and Reagent B.
d. (3 pts) In the labeled boxes, provide the structure of the **Product Conjugate Base**, the structure of **Reagent C** that needs to be added to the Product Conjugate Base to obtain Product 1-hexanol, and the **Inorganic Byproduct** formed.



27.

a. (1pt) Draw an **arrow** that shows the flow of electrons when **BBr_3 reacts with methyl neopentyl ether** to form Intermediate A.

b. (1 pt) In the labeled box, provide the **structure of Intermediate A.**

c. (1 pt) In your structure for Intermediate A, draw **arrows** that show the flow of electrons when **Intermediate A collapses** upon heating.

d. (2 pts) In the appropriately labeled boxes, provide the **structure of Product #1** and **Intermediate B** formed upon collapse of Intermediate A.

e. (2 pts) After addition of water, provide the **structure of Product #2** and the **structure of the Inorganic Byproduct** formed upon reaction of Intermediate B with water.