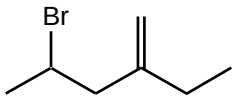
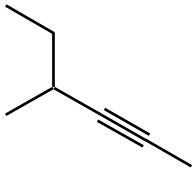
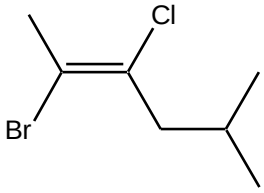
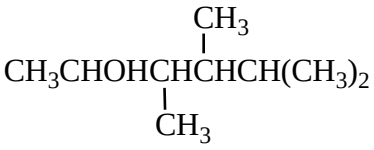
Organic Chemistry I
Exam 4 20101
Name KEY

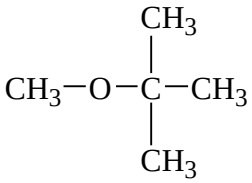
Multiple Choice - Circle the letter of the best choice for the answer to the question.
(2 1/3 Points each)

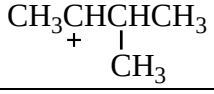
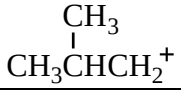
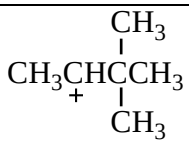
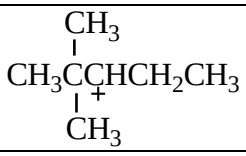
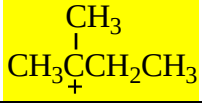
1.	The correct IUPAC name for the following compound is: 			
	A)	2-Bromo-4-methylenehexane	B)	2-Bromo-4-ethyl-1-pentene
	C)	2-(2-Bromopropyl)-1-butene	D)	2-Bromo-4-ethyl-4-pentene
	E)	4-Bromo-2-ethyl-1-pentene		

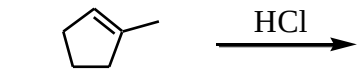
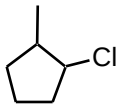
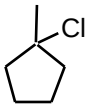
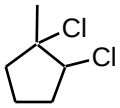
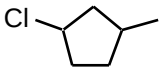
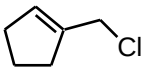
2.	Give the IUPAC name for 			
	A)	3-Methyl-4-hexyne	B)	4-Ethyl-2-pentyne
	C)	4-Methyl-2-hexyne	D)	3-Methyl-2-hexyne
	E)	2-Ethyl-3-pentyne		

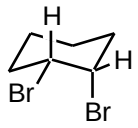
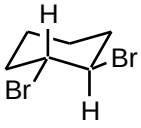
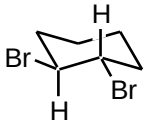
3.	The correct IUPAC name for the following compound is: 			
	A)	(E)-2-Bromo-3-chloro-5-methyl-2-hexene	B)	(Z)-2-Bromo-3-chloro-5-methyl-2-hexene
	C)	(E)-2-Bromo-3-chloro-5-methyl-3-hexene	D)	(E)-2-Methyl-5-bromo-4-chloro-4-hexene
	E)	(Z)-2-Bromo-3-chloro-5-methyl-3-hexene		

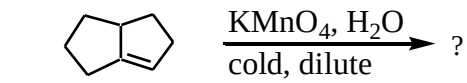
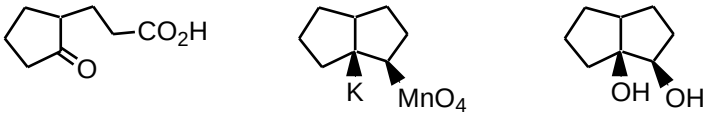
4.	What is the correct IUPAC name for the following compound? 			
	A)	4-isopropyl-3,4-dimethyl-2-butanol	B)	3,4,5-trimethyl-2-hexanol
	C)	2,3,4-trimethyl-4-pentanol	D)	3,4,5,5-tetramethyl-2-pentanol
	E)	1,1,2,3-tetramethyl-4-pentanol		

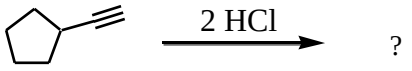
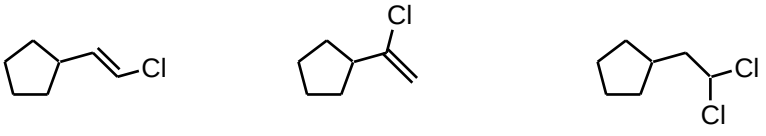
5.	Methyl tert-butyl ether has the IUPAC name: 			
	A)	methyl dimethylethyl ether	B)	*t*-butoxymethane
	C)	methyoxy-*t*-butane	D)	1,1-dimethyl-1methoxyethane
	E)	2-methoxy-2-methylpropane		

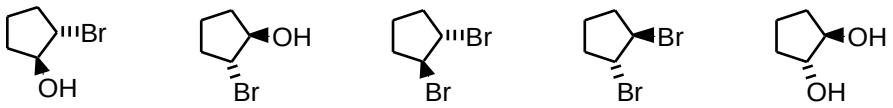
6.	Which of the following carbocations would NOT be likely to undergo rearrangement?			
	A)		B)	
	C)		D)	
	E)			

7.	What would be the major product of the following reaction?   I  II  III  IV  V			
	A)	I	B)	II
	C)	III	D)	IV
	E)	V		

8.	The reaction of Br_2/CCl_4 to cyclohexene would produce the compound(s) represented by structure(s):  I  II  III			
	A)	I alone	B)	II alone
	C)	III alone	D)	I , II and II
	E)	II and III (enantiomers)		

9.	What product would result from the following reaction?   I II III  IV V			
	A)	I	B)	II
	C)	III	D)	IV
	E)	V		

10.	Select the structure of the major product formed in the following reaction.   I II III  IV V			
	A)	I	B)	II
	C)	III	D)	IV
	E)	V		

11.	Which of these is not formed when cyclopentene reacts with an aqueous solution of bromine (Br_2 in H_2O)?  I II III IV V			
	A)	I	B)	II
	C)	III	D)	IV
	E)	V		

12.	How many compounds are possible from the addition of bromine to CH_2=$CHCH_2CH_3$ (counting stereoisomers separately)?			
	A)	One	B)	Two
	C)	Three	D)	Four
	E)	Five		

13.	In general, when the addition of an unsymmetrical electrophilic reagent to an unsymmetrical alkene forms the product predicted by Markovnikov's rule, that occurs because:			
	A)	the product is statistically favored.	B)	it is the more/most stable product.
	C)	steric hindrance favors its formation.	D)	it is formed via the more/most stable carbocation.
	E)	All of the above are reasons.		

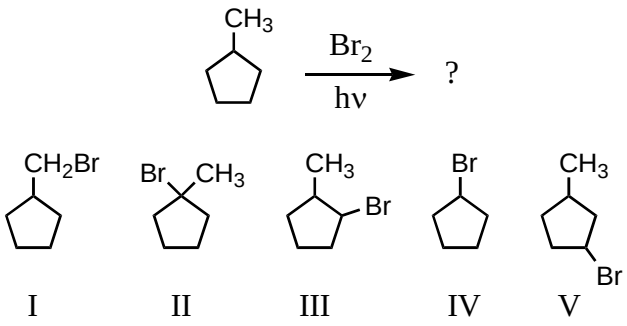
14.	Which of these compounds belongs to the class of substances commonly known as "halohydrins"?			
	A)	$BrCH_2CH_2Cl$	B)	$FCH_2CH_2NH_2$
	C)	$ClCH_2CO_2H$	D)	$HOCH_2$ COCl
	E)	ICH_2CH_2OH		

15.	The most resistant compound to the action of hot alkaline $KMnO_4$ is:			
	A)	Pentane	B)	2-Pentyne
	C)	1-Pentene	D)	Cyclopentene
	E)	2-Pentene		

16.	Consider the ozonolysis products obtained from all the unbranched and unsymmetrical isomers of heptene. The reaction product in each case would consist of:			
	A)	a single aldehyde.	B)	two different aldehydes.
	C)	an aldehyde and a ketone.	D)	a single ketone.
	E)	two different ketones.		

17.	In the presence of light, ethane (1 mol) reacts with chlorine (1 mol) to form which product(s)?			
	A)	$CH_2ClCHCl_2$	B)	$ClCH_2CH_2Cl$
	C)	CH_3CHCl_2	D)	All of these
	E)	CH_3CH_2Cl (one point for this one)		

18.	Select the structure of the major product formed in the following reaction.			

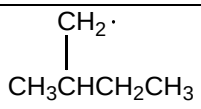
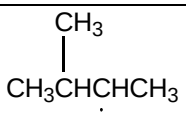
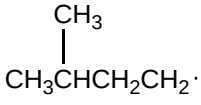
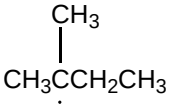
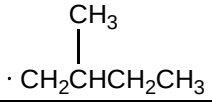


	A)	I	B)	II
	C)	III	D)	IV
	E)	V		

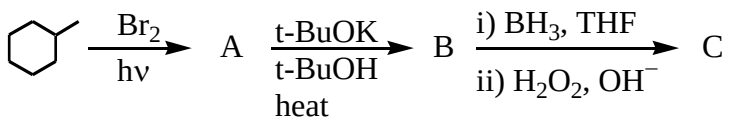
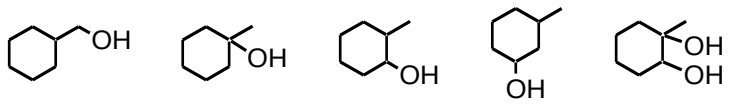
19.	Which of the following combinations of reactants can provide a demonstrable example of anti-Markovnikov addition?			
	A)	$CH_2=CHCH_3$ + HCl + ROOR	B)	$CH_3CH_2CH=CH_2$ + HBr + ROOR
	C)	$CH_3CH=CH_2$ + H_2O + Cl_2	D)	$CH_3CH_2CH=CH_2$ + Br_2 + ROOR
	E)	$CH_3CH=CHCH_3$ + HBr + ROOR		

20.	What sequence of reactions could be used to prepare cis-1,2-cyclopentanediol from cyclopentane?
A)	(1) Cl_2, hν; (2) t-BuOK/t-BuOH; (3) OsO_4; (4) $NaHSO_3/H_2O$
B)	(1) t-BuOK/t-BuOH; (2) Cl_2, hν; (3) $NaOH/H_2O$
C)	(1) Cl_2, hν; (2) t-BuOK/t-BuOH; (3) H_2O_2
D)	(1) $NaOH/H_2O$; (2) Br_2; (3) $NaNH_2$(2eq.)/liq.NH_3; (4) $KMnO_4$, $NaOH/H_2O$, 5°C
E)	(1) Cl_2, hν; (2) t-BuOK/t-BuOH; (3) $Hg(OAc)_2$, H_2O (4) $NaBH_4$, H_3O+

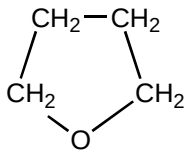
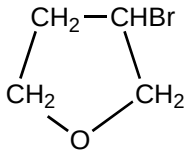
21.	The p-orbital of a methyl radical carbon, $CH_3\cdot$, contains how many electrons?		
A)	1	B)	2
C)	3	D)	4
E)	0		

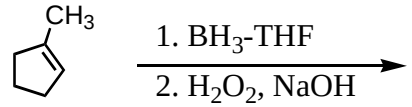
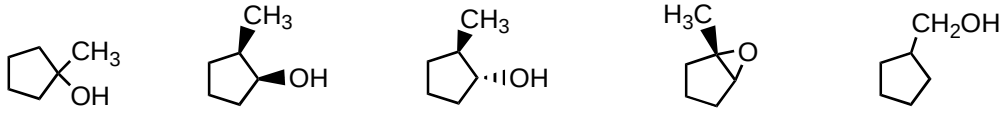
22.	Which of the following free radicals is the most stable?		
A)		B)	
C)		D)	
E)			

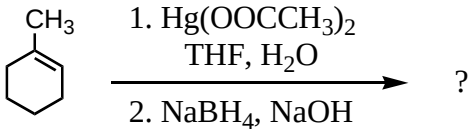
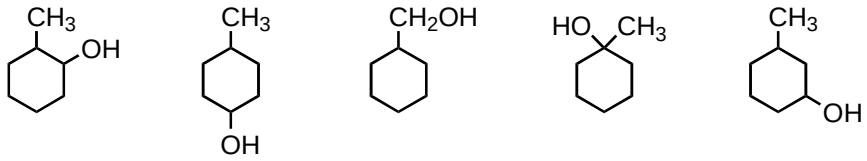
23.	Free radicals can be produced by:			
	A)	use of high temperatures.	B)	reaction of a molecule with another free radical.
	C)	irradiation with light.	D)	both A) and B).
	E)	all of A), B) and C).		

24.	What is the final product, C, obtained via the following reaction sequence?   			
	A)	I	B)	II
	C)	III	D)	IV
	E)	V		

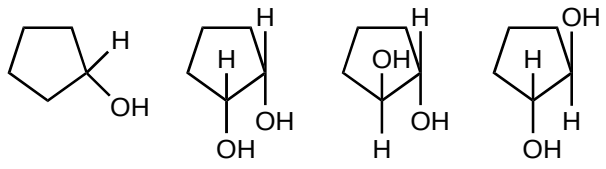
25.	Which of the following reactions would serve as a synthesis of butyl bromide?	
	A)	$CH_3CH_2CH_2CH_2OH + HBr \xrightarrow{\text{reflux}}$
	B)	$CH_3CH_2CH_2CH_2OH + PBr_3 \longrightarrow$
	C)	$CH_3CH_2CH_2CH_2OH + NaBr \xrightarrow{\text{reflux}}$
	D)	$CH_3CH_2CH_2CH_2OH + Br_2 \longrightarrow$
	E)	Answers A) and B) only (one point for A or B)

26.	The product(s) of the following reaction  is/are:			
	$CH_3CH_2OCH_2CH_3$ I		$CH_3CH_2CH_2CH_2OH$ and $CH_3CH_2CH_2CH_2Br$ II	
	$BrCH_2CH_2CH_2CH_2OH$ and $BrCH_2CH_2CH_2CH_2Br$ III		 IV	
	A)	I	B)	II
	C)	III (Excess HBr)	D)	IV
	E)	None of these (1 point for this)		

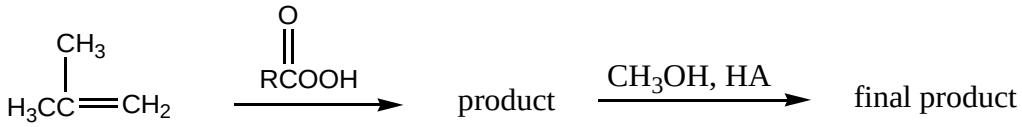
27.	Which product(s) would you expect to obtain from the following sequence of reactions?   I + enantiomer II + enantiomer III + enantiomer IV V			
	A)	I	B)	II
	C)	III (Syn addition of H and OH)	D)	IV
	E)	V		

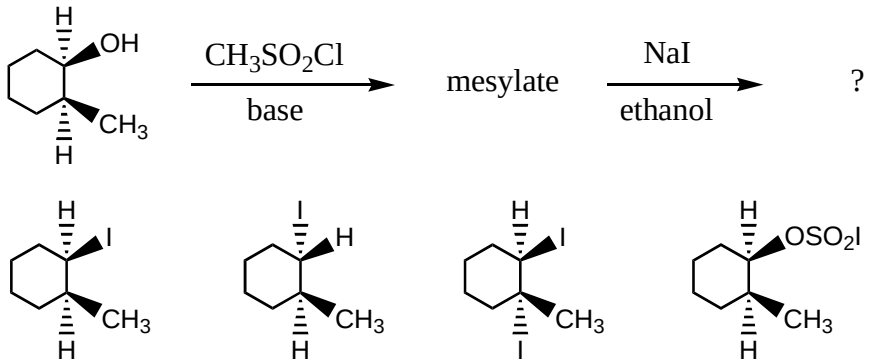
28.	Select the structure of the major product formed from the following reaction.   I II III IV V			
	A)	I	B)	II
	C)	III	D)	IV
	E)	V		

29.	Which is the best way to prepare 3-methoxypentane via the Williamson method? (Hint - Draw the structure of the product first.)	
	A)	$CH_3OH + CH_3CH_2CHOHCH_2CH_3 + H_2SO_4$, 140°C
	B)	$CH_3OH + (CH_3)_2CHCH_2CH_2OH + H_2SO_4$, 140°C
	C)	$CH_3ONa + (CH_3CH_2)_2CHBr$ (Mostly E2)
	D)	$CH_3I + (CH_3CH_2)_2CHONa$
	E)	$CH_3I + (CH_3)_2CHCH_2CH_2ONa$

30.	Epoxidation followed by reaction with aqueous base converts cyclopentene into which of these?  I II III IV			
	A)	I	B)	II
	C)	III	D)	IV

	E)	Equal amounts of III and IV		(III and IV are enantiomers)

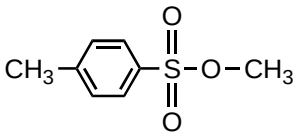
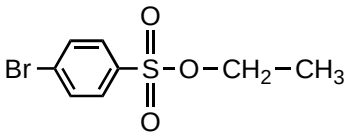
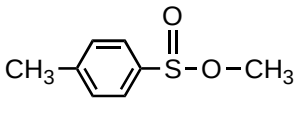
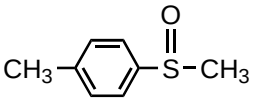
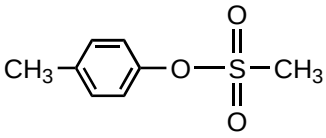
31.	What would be the final product? 	
	A)	$(CH_3)_2CHCH_2OCH_3$
	B)	$(CH_3)_2CCH_3$ | OCH3
	C)	$(CH_3)_2CCH_2OH$ | OCH3 (the nucleophile attacks the most sub. C in acidic conditions (HA))
	D)	$(CH_3)_2CCH_2OCH_3$ | OH
	E)	$(CH_3)_2CCH_2OCH_3$ | OCH3

32.	What would be the major product of the following reaction? 			
	A)	I	B)	II (SN2 backside by I⁻ after *mes* formed from -OH)
	C)	III	D)	IV
	E)	V		

33.	Which of the compounds listed below would you expect to have the highest boiling point? (They all have approximately the same molecular weight.)			
	A)	$CH_3CH_2CH_2CH_2CH_3$	B)	$CH_3CH_2CH_2Cl$
	C)	$CH_3CH_2CH_2CH_2OH$	D)	$CH_3CH_2OCH_2CH_3$
	E)	$CH_3CH_2CH_2OCH_3$		

34.	The following reaction, $CH_3CH_2CH_2CH_2OH \xrightarrow[\text{heat}]{\text{HBr}} CH_3CH_2CH_2CH_2Br + H_2O$ is probably:	
	A)	An S_N1-type reaction involving the protonated alcohol as the substrate.
	B)	An S_N2-type reaction involving the protonated alcohol as the substrate.
	C)	An E1-type reaction involving the protonated alcohol as the substrate.
	D)	An E2-type reaction involving the protonated alcohol as the substrate.
	E)	An epoxidation reaction.

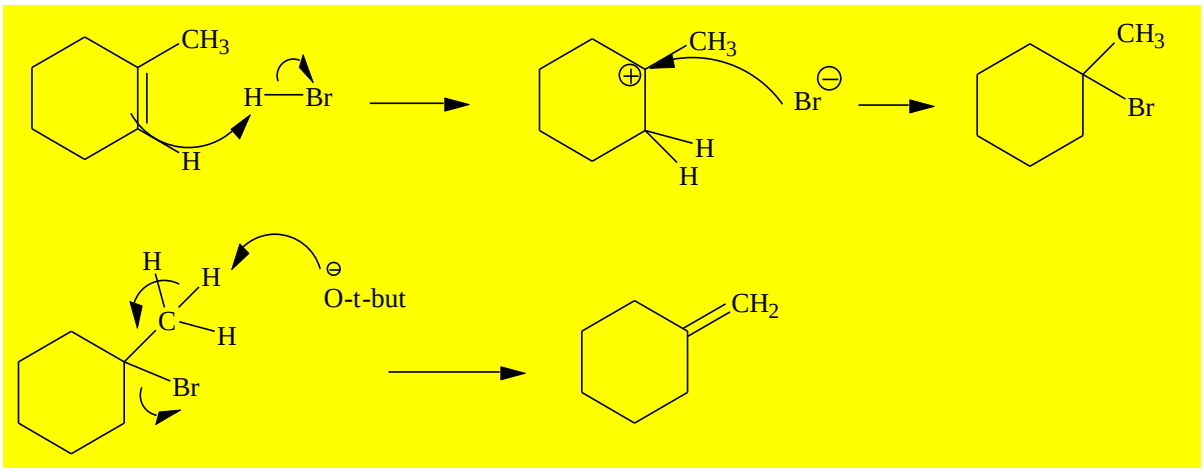
35.	Which of the following statements is NOT true of ethers?	
	A)	Ethers are <u>generally</u> unreactive molecules toward reagents other than certain strong acids.
	B)	Ethers <u>generally</u> have lower boiling points than alcohols of a corresponding molecular weight.
	C)	Ethers cannot H-bond with water. (It can, but not with another ether molecule)
	D)	Ethers can <u>generally</u> be cleaved by heating them with HBr or HI.
	E)	Ethers form peroxides when allowed to stand in the presence of oxygen. (Hint - This is true)

36.	Which compound is a tosylate?  I  II  III  IV  V			
	A)	I	B)	II
	C)	III	D)	IV
	E)	V		

Mechanisms – Write the mechanism for the following reaction. Use curved arrow notation and indicate the removal of any protons if necessary.

The reaction of 1-methylcyclohexene with HBr followed by the reaction of the product with *t*-butoxide in *t*-butyl alcohol at 60°Cto make an alkene different from the starting material. (8 Points)

Electron "dots" not shown in solutions to make drawing easier. You should have shown them.


CH3
H
Br
H
CH3
Br
H
H
CH3
Br
H
H
H
C
H
O-t-but
Br
CH2

Mechanisms – Write the mechanism for the following reaction. Use curved arrow notation and indicate the removal of any protons if necessary.

The reaction of ethyl alcohol molecules in the presence of concentrated sulfuric acid at 140° to produce diethyl ether. (8 points)