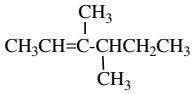
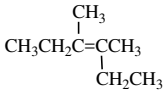
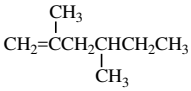
1. An alkene adds hydrogen in the presence of a catalyst to give 3,4-dimethylhexane. Ozonolysis of the alkene followed by treatment with zinc and acetic acid gives a single organic product. The structure of the alkene is:



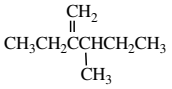
A (cis or trans)



B (cis or trans)



C



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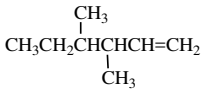
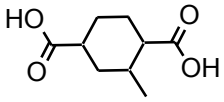


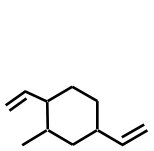
E

2. Determine a possible structure for an alkene, X, formula C_9H_{14}, on the basis of the following information: X adds one mole of hydrogen on catalytic hydrogenation. On treatment with hot basic $KMnO_4$ followed by acidification, X yields the following dicarboxylic acid.

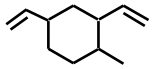


A possible structure for X might be:

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

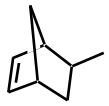


I



II

III



IV

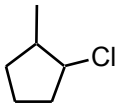
V

3. Which reagent or test could be used to distinguish between 2-methyl-2-pentene and 2-methylpentane?

A. Br_2/CCl_4 B. $KMnO_4$, OH^- C. Concd. H_2SO_4 D. Two of the above E. All of the above

4. What would be the major product of the following reaction?

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



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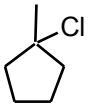

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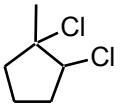

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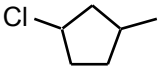

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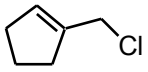


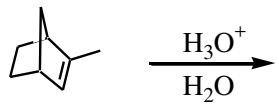
V

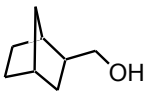
5. What is the chief product of the reaction of IBr with 2-methyl-2-pentene?

A. 2-bromo-3-iodo-2-methylpentane
B. 3-bromo-2-iodo-2-methylpentane
C. 1-bromo-2-iodo-2-methylpentane
D. 2-bromo-1-iodo-2-methylpentane
E. All of the above

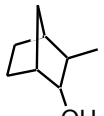
6. Which product would you expect from the following reaction?

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





I



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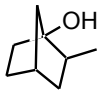

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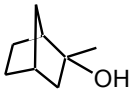

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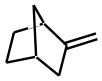
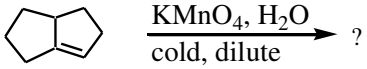
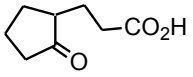


V

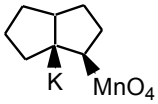
7. What product would result from the following reaction?

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





I



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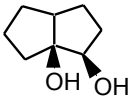

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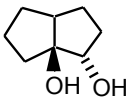
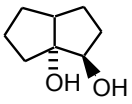


IV



V

8. Which of these compounds is <u>not</u> formed when gaseous ethene is bubbled into an aqueous solution of bromine, sodium chloride and sodium nitrate?

A. $BrCH_2CH_2Br$ B. $BrCH_2CH_2Cl$ C. $BrCH_2CH_2OH$ D. $ClCH_2CH_2OH$ E. $BrCH_2CH_2ONO_2$

9. When either <u>cis</u>- or <u>trans</u>-2-butene is treated with hydrogen chloride in ethanol, the product mixture that results includes:

A. $CH_3CH_2CH_2CH_2Cl$
B. $CH_3CH_2CH_2CH_2OCH_2CH_3$
C. $CH_3CH_2CH(CH_3)OCH_2CH_3$
D. $(CH_3)_3CCl$
E. $(CH_3)_2CHCH_2OCH_2CH_3$

10. Cyclohexene is treated with cold dilute alkaline $KMnO_4$. The spatial arrangement of the two hydroxyl groups in the product would be:

A. equatorial-axial B. axial-axial C. equatorial-equatorial D. coplanar E. trans

11. The interaction of the π bond of an alkene with an electrophile can initially result in the formation of a species termed a π complex. Which of these cannot combine with an alkene to form a π complex?

A. H^+ B. NH_3 C. Ag^+ D. Hg^{2+} E. BF_3

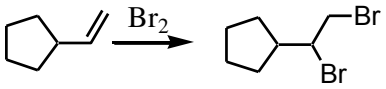
12. Markovnikov addition of HI to 2-methyl-2-butene involves:

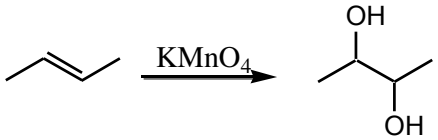
A. initial attack by an iodide ion.
B. initial attack by an iodine atom.
C. isomerization of 2-iodo-2-methylbutene.
D. formation of a carbocation at C-2.
E. formation of carbocation at C-3.

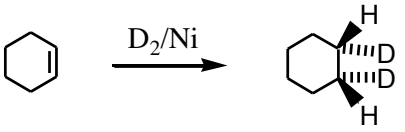
13. Which reaction is regioselective?

A. I
B. II
C. III
D. IV
E. None of these

I 

II 

III 

IV 

14. Which alkene would you expect to be most reactive toward acid-catalyzed hydration?

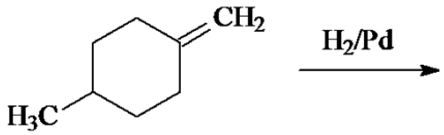
A. 1 pentene
B. *trans*-2-pentene
C. *cis*-2-pentene
D. 2-methyl-1-butene
E. All of these would be equally reactive.

15. Which of the following alkenes is expected to have the highest heat of hydrogenation?

A. 1-pentene B. *trans*-2-pentene C. *cis*-2-pentene D. 2-methyl-2-butene

16. The product(s) in the following reaction is(are)

A. only *trans*-1-4-dimethylcyclohexane.
B. only *cis*-1-4-dimethylcyclohexane.
C. both *trans* and *cis*-1-4-dimethylcyclohexane.
D. methylcyclohexane.



17. Which of the following is not a possible reaction of a carbocation?

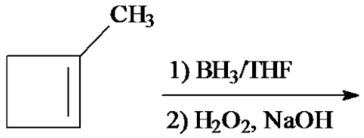
A. addition of a nucleophile
B. rearrangement to a more stable carbocation
C. addition of a proton to form an alkane
D. loss of a β-hydrogen to form an alkene

18. Addition of HCl to 3-methyl-1-pentene gives two products. One of these is 2-chloro-3-methylpentane. What is the other product?

A. 1-chloro-3-methylpentane
B. 3-chloro-3-methylpentane
C. 3-chloro-2-methylpentane
D. 2-chloro-2-methylpentane

19. What is(are) the product(s) of the following hydroboration-oxidation reaction?

A. 1-methylcyclobutanol
B. *cis*-2-methylcyclobutanol
C. *trans*-2-methylcyclobutanol
D. equal amounts of 2 and 3



20. Which species below is the intermediate in the free radical addition of HBr to 1-butene?

A) $H_3C-CH_2-\dot{C}H-CH_3$

B) $H_3C-CH_2-CH_2-\dot{C}H_2$

C) $H_3C-CH_2-\dot{C}H-CH_2Br$

D) $H_3C-CH_2-\underset{\displaystyle Br}{\underset{|}{CH}}-\dot{C}H_2$

21. Which reagent(s) below would work best in converting 2-methyl-2-hexene to 2-methyl-3-hexanol?

A. 50% H_2SO_4/H_2O
B. (1) BH_3/THF (2) H_2O_2, NaOH
C. Br_2/H_2O
D. (1) $Hg(OAc)_2/THF/H_2O$ (2) $NaBH_4$, HO^-
E. (1) RCO_3H (2) H^+, H_2O

22. What is the major product of the following reaction?

A. 1,2-dibromo-2-methylhexane
B. 2,3-dibromo-2-methylhexane
C. 2,2-dibromo-2-methylhexane
D. 2,4-dibromo-2-methylhexane

$$CH_3CH_2CH_2CH{=}C(CH_3)_2 \;+\; Br_2 \longrightarrow$$

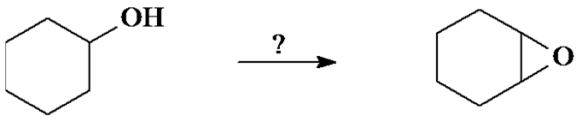
23. Which of the following series of reactions would convert cyclohexanol to 1,2-epoxycyclohexane?

A) (1) $NaOCH_2CH_3$ (2) Br_2, H_2O

B) (1) Br_2, light (2) $NaOCH_2CH_3$

C) (1) H_2SO_4, heat (2) $CH_3\overset{\displaystyle O}{\overset{\|}{C}}OOH$, CH_3CO_2H

D) (1) H_2SO_4, heat (2) O_3 (3) Zn, H_2O



24. A compound, $C_{20}H_{30}$, can be hydrogenated with platinum metal and hydrogen to give a compound $C_{20}H_{38}$. How many double bonds (DB) and rings (R) does the original compound have? (The original compound has no triple bonds.)

A. 4 DB, 2 R B. 4 DB, 1 R C. 3 DB, 3 R D. 2 DB, 4 R

25. Which of the following species is the intermediate in the bromination of propene?

A) $H_2\overset{\ominus}{\overset{\cdot\cdot}{C}}-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3$ B) $H_2\overset{\oplus}{C}-\underset{\displaystyle Br}{\underset{|}{CH}}-CH_3$

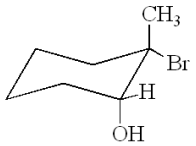
C) $H_2C\!-\!\overset{\displaystyle \oplus Br}{\overset{/\ \backslash}{}}\!-\!CH-CH_3$ D) $H_2C\!-\!\overset{\displaystyle \ominus Br}{\overset{/\ \backslash}{}}\!-\!CH-CH_3$

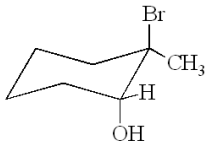
26. The rearrangement which occurs in the following reaction can be described as a

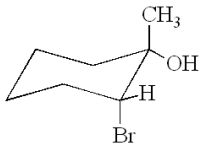
A. hydride shift from C-2 to C-1.
B. proton shift from C-2 to C-1.
C. hydride shift from C-3 to C-2.
D. methyl group shift from C-3 to C-2.

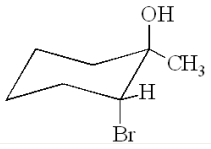
$$\underset{\displaystyle 3\quad 2\quad 1}{(CH_3)_2CHCH{=}CH_2} \xrightarrow{HBr}$$

27. Addition of hypobromous acid, HOBr, to 1-methylcyclohexene gives:

A) 

B) 

C) 

D) 

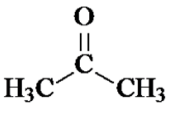
28. A compound is treated with ozone followed by zinc in water to give the following three products. Which structure below best fits the data?

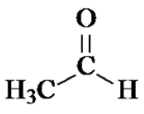
A) $CH_3CH{=}CH(CH_2)_3CH{=}C(CH_3)_2$

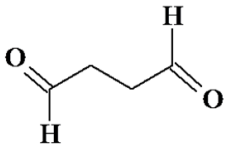
B) $(CH_3)_2C{=}CHCH_2CH_2CH{=}CHCH_3$

C) $H_2C{=}C(CH_3)CH_2CH_2C(CH_3){=}CHCH_3$

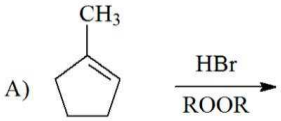
D) $H_2C{=}CHCH_2CH_2C(CH_3){=}C(CH_3)_2$

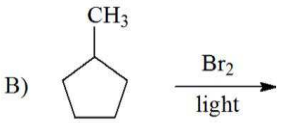


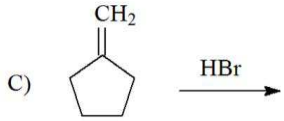


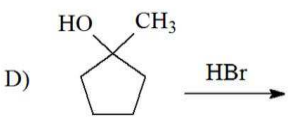


29. Which of the following does ***not*** give 1-bromo-1-methylcyclopentane as the major product?

A) 

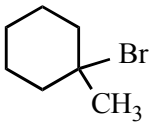
B) 

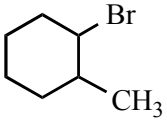
C) 

D) 

30. What reagents would be required to accomplish the conversion shown below?

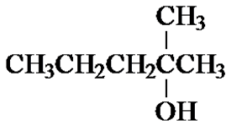
A. $NaOCH_3$, then Br_2 and light.
B. $NaOCH_3$, then HBr.
C. $KOCH_3$, then HBr and peroxides.
D. KO^tBu, then Br_2 and light.

make 

into 

31. Which reagent(s) below would convert 2-methyl-2-pentene to 2-methyl-2-pentanol (shown below)?

A. (1) O_3 (2) Zn, H_2O
B. Br_2/H_2O
C. (1) BH_3/THF (2) H_2O_2, NaOH
D. (1) $Hg(OAc)_2$/THF/H_2O (2) $NaBH_4$, HO^-



(2-methyl-2-pentanol)

32. Which reaction sequence below would work ***best*** in converting 3-pentanol into 2,3-dibromopentane?

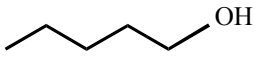
A) (1) H_2SO_4, heat (2) HBr (3) Br_2, light

B) (1) H_2SO_4, heat (2) H_2/Pt (3) 2 Br_2, light

C) (1) Br_2, light (2) H_2SO_4, heat (3) H_2/Pt

D) (1) H_2SO_4, heat (2) Br_2

33. Which of the alcohols below could ***not*** be prepared using hydroboration/oxidation of an alkene?

A


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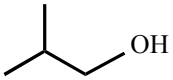
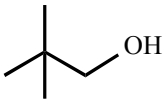
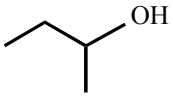
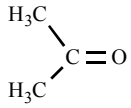
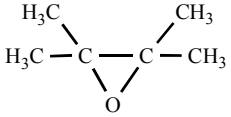


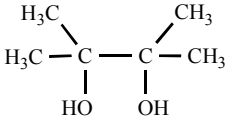
C


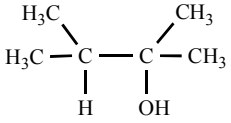
D


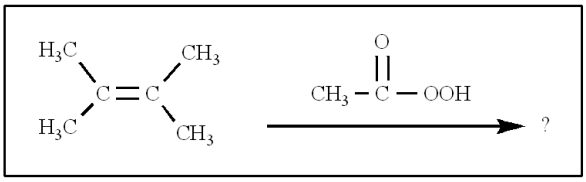
34. What product results from this reaction?

A


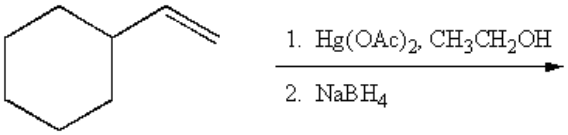
B


C


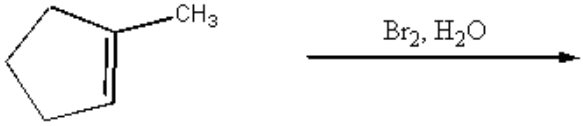
D




35. Provide the structure of the major organic product of the reaction shown.



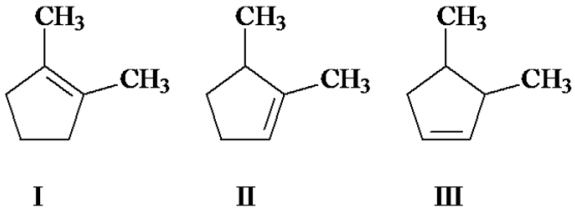
36. Provide the structure of the major organic product of the reaction shown.



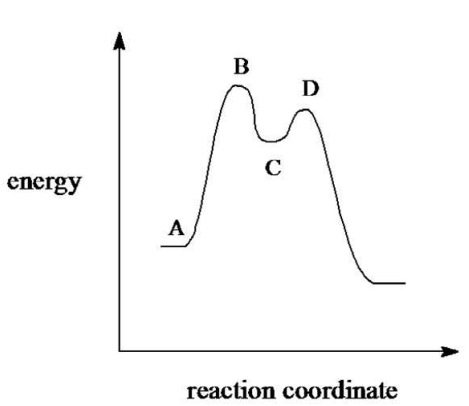
EXTRA CREDIT

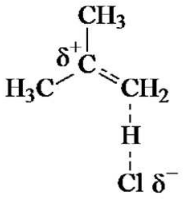
37. Rank the following in order of decreasing reactivity with bromine, Br_2.

A. I > II > III
B. II > III > I
C. III > I > II
D. III > II > I



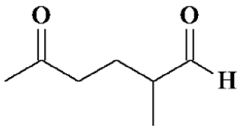
38. Which point on the potential energy diagram corresponds to the species below for the reaction of 2-methylpropene with hydrogen chloride?



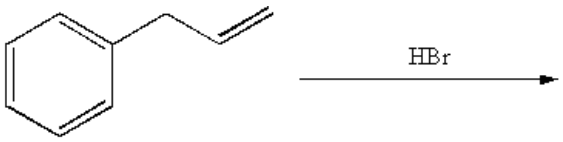


39. A compound, $C_7H_{13}Cl$, is reacted with sodium ethoxide and gives a single elimination product, C_7H_{12}. Treatment with ozone followed by zinc and water gives the compound below. Identify the original compound.

A. 2-chloro-1,1-dimethylcyclopentane
B. 4-chloro-1,2-dimethylcyclopentane
C. 1-chloro-1,2-dimethylcyclopentane
D. 2-chloro-1,3-dimethylcyclopentane



40. Provide the structure of the major organic product of the reaction shown.



NAME_____ **DATE**_____

ANSWER SHEET

CHEM 241 – CHAP 6 ASSIGN

1. _____	11. _____	21. _____	31. _____
2. _____	12. _____	22. _____	32. _____
3. _____	13. _____	23. _____	33. _____
4. _____	14. _____	24. _____	34. _____
5. _____	15. _____	25. _____	35. _____
6. _____	16. _____	26. _____	36. _____
7. _____	17. _____	27. _____	37. _____
8. _____	18. _____	28. _____	38. _____
9. _____	19. _____	29. _____	39. _____
10. _____	20. _____	30. _____	40. _____

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