CHEMISTRY 208
Final

Spring 95-96
2 Hours

Family Name _____
First Name _____
ID No _____

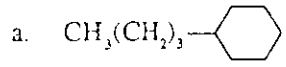
Instructions

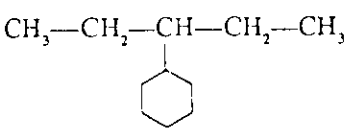
Answer all questions
All answers must be clearly indicated by a vertical line in the box of your choice on the answer sheet as indicated below:

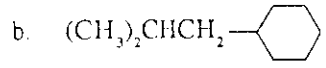
If you make a mistake cross it out, as indicated below:

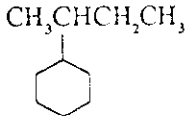
There is only one correct answer per question
There is no penalty for a wrong answer
If more than one box is filled per question (except to cross out mistakes), then that question will not be graded.

1. Which compound below is *sec*-butylcyclohexane?

a. 

c. 

b. 

d. 

2. Which is the reaction that alkenes do not undergo?

a. elimination
b. addition
c. oxidation
d. polymerization

3. The first step in the acid catalyzed dehydration of an alcohol to yield an alkene is:

a. loss of OH^- to form a carbocation
b. loss of water to form a carbocation
c. protonation of the —OH group to form a protonated alcohol
d. loss of a proton from the alcohol to form a carbocation.

4. Which alkene is not formed when 3-methyl-1-pentanol is dehydrated?

a. 3-methyl-1-pentene
b. 3-methyl-2-pentene
c. 2-ethyl-1-butene
d. 2-methyl-1-pentene

5. Which compound yields two aldehydes upon treatment with O_3/Zn?

a. 2,3-dimethyl-1-pentene
b. 3,3-dimethyl-1-pentene
c. 2,3-dimethyl-2-pentene
d. 2,4-dimethyl-2-pentene

6. Which of the following reactions does not yield 2-bromobutane?

a. 1-butene + HBr (no peroxides)
b. 1-butene + HBr (peroxides)
c. 2-butene + HBr (no peroxides)
d. 2-butene + HBr (peroxides)

7. The most stable carbocation is

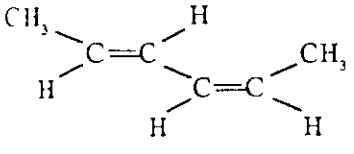
a. $CH_2{=}CH\overset{+}{C}H_2$

b. $CH_3CH{=}\overset{+}{C}H_2$

c. $CH_3\overset{+}{C}{=}CH_2$

d. $CH_3CH_2\overset{+}{C}H_2$

8. The name of the compound below is



a. (*Z*), (*Z*)-2,4-hexadiene
b. (*E*), (*E*)-2,4-hexadiene
c. (*E*), (*Z*)-2,4-hexadiene

9. The name of the compound below is

$CH_3CH(CH_2CH_3)CH_2C{\equiv}CC(CH_3)_3$

a. 6-ethyl-2,2-dimethyl-3-heptyne
b. 2,2,6-trimethyl-3-octyne
c. *t*-butylisopropylacetylene
d. 2,6-dimethyl-3-heptyne

10. Addition of HCl (1 mole, high temperature) to 1,3-butadiene yields _____ as the major product.

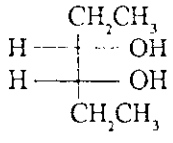
a. 4-chloro-1-butene
b. 3-chloro-1-butene
c. 1-chloro-2-butene
d. 3-chloro-2-butene

11. How many optical isomers of 1,2-dichlorocyclohexane are there?
a. one
b. two
c. three
d. four

12. Which of the following is *not* true for enantiomers?
A. They have the same boiling point.
B. They have the same melting point.
C. They have the same chemical reactivity with archiral reagents.
D. They have the same reactivity with chiral reagents.
E. They have the same density.
F. They have the same specific rotation.
a. C and F
b. D and F
c. F
d. all but F

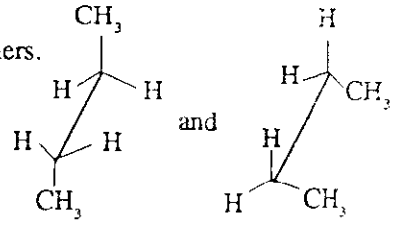
13. Which of the following statements is correct?
a. The instrument used for measuring optical activity is called polaroscope.
b. All compounds with chiral centers are optically active.
c. Both (a) and (b)
d. Neither (a) nor (b)

14. The correct stereochemical designation for this compound is_____-3,4-hexanenediol

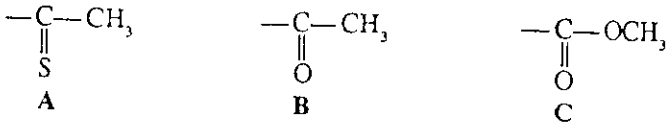


a. (3*R*, 4*R*)
b. (3*S*, 4*S*)
c. (3*R*, 4*S*)
d. (3*R*)
e. (4*S*)

15. The relationship between these compounds is that they are
a. superimposable without bond rotation.
b. diastereomers.
c. enantiomers.
d. conformational isomers.



16. Arrange the following three groups in the order of highest to lowest priority.



A **B** **C**

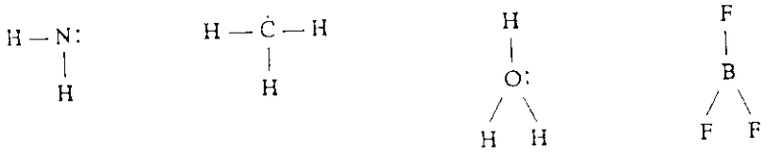
a. A > B > C
b. C > B > A
c. A > C > B
d. B > C > A

17. Which of the following compounds would undergo S_N2 most rapidly?
a. 1-chloropentane
b. 2-chloropentane
c. 2-chloro-2-methylbutane
d. neopentylchloride

18. Which compound would undergo E1 reaction the fastest?
a. 1-chlorobutane
b. 2-chlorobutane
c. 2-chloro-2-methylbutane
d. neopentylchloride

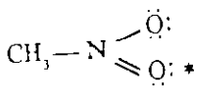
19. The function of $FeBr_3$ in Friedel-Crafts alkylations is
a. to form a complex with benzene, thus increasing its reactivity.
b. to complex with the carbocation, thus stabilizing it.
c. to abstract the halide from the alkyl halide, thus forming a carbocation.
d. to abstract the proton from the σ complex and regenerate the aromatic ring.

20. What is the charge on each of the species below?



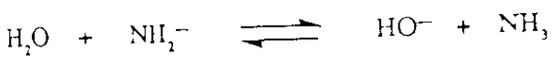
a. +1, −1, −1, 0
b. −1, 0, +1, 0
c. 0, +1, +1, 0
d. +1, 0, +1, 0

21. The formal charges on nitrogen and the starred oxygen atom of the compound shown below are



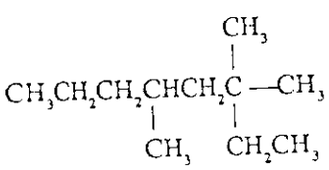
a. N +1; O* 0
b. N +1; O* −1
c. N +1; O* +1
d. N −1; O* 0

22. In the reaction below, the strong base is



a. H_2O
b. NH_2^-
c. HO^-
d. NH_3

23. What is the correct IUPAC name of the compund shown below?



a. 4,6-dimethyl-6-ethylpentane
b. 2,4-dimethyl-2-ethylheptane
c. 3,3,5-trimethyloctane
d. 4,6-dimethyl-6-isobutylpentane

24. The eclipsed and staggered forms of ethane are said to differ in
a. configuration
b. conformation
c. resonance
d. constitution

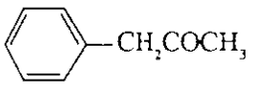
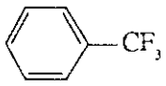
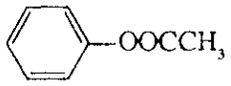
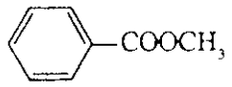
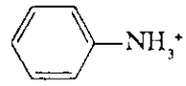
25. Compound C_5H_{12} forms four structurally different monochloroderivatives. C_5H_{12} is, therefore,
a. *n*-pentane
b. 2-methylbutane
c. 2, 2-dimethylpropane
d. 2, 3-dimethylpropane

26. Which of the following statement(s) for dimethylcyclohexane is/are correct?
A. *cis*-1,2-is more stable than *trans*-1,2.
B. *cis*-1,3-is more stable than *trans*-1,3.
C. *cis*-1,4-is more stable than *trans*-1,4.

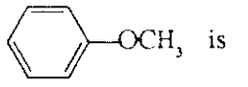
a. B
b. A and C
c. C only
d. all are correct

27. Which is the only name that is correct?
a. 2-ethyl-1-butene
b. 1-methyl-2-cyclohexene
c. 2-ethyl-2-butene
d. 3-ethyl-1-butene

28. The major mononitration product of the following compounds is

a.	*o*–/*p*–	*m*–	*o*–/*p*–	*m*–	*m*–
b.	*m*–	*o*–/*p*–	*o*–/*p*–	*m*–	*m*–
c.	*o*–/*p*–	*o*–/*p*–	*m*–	*m*–	*m*–
d.	*m*–	*m*–	*o*–/*p*–	*o*–/*p*–	*o*–/*p*–

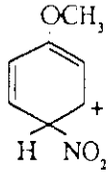
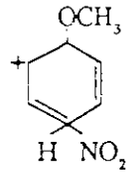
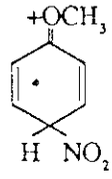
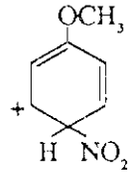
29. The common name for  is

a. aniline
b. toluene
c. anisole
d. acetophenone

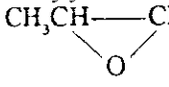
30. The presence of chlorine on the benzene ring _____ the ring and directs the electrophile _____.

a. activates; *o*–/*p*–
b. deactivates; *o*–/*p*–
c. activates; *m*–
d. deactivates; *m*–

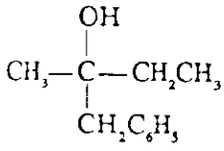
31. Which is the incorrect resonance formula in the nitration of anisole?

a. 
b. 
c. 
d. 

32. What reactants would be used to prepare *t*-butyl alcohol?

a. $(CH_3)_3CCl$ + (1:1) H_2O:THF/K_2CO_3
b.  + CH_3MgI
c. $(CH_3)_3CMgBr$ + CO_2
d. $(CH_3)_2C{=}CH_2$ + B_2H_6 + H_2O_2

33. Give the best route for the synthesis of this alcohol:



a. $C_2H_5COOCH_3$ + C_6H_5MgBr ⟶
b. $C_2H_5COCH_3$ + $C_6H_5CH_2MgBr$ ⟶
c. $CH_3COCH_2C_6H_5$ + $CH_3CH_2CH_2MgBr$ ⟶
d. $CH_3CH_2CH(CH_3)MgBr$ + C_6H_5CHO ⟶

34. Which of the following Grignard reactions does *not* yield the indicated product?

a. $2\,CH_3CH_2MgI$ + $CH_3COOC_2H_5$ ⟶ $(C_2H_5)_2C(OH)CH_3$
b. CH_3CH_2MgI + C_6H_5COOH ⟶ $C_6H_5COC_2H_5$
c. CH_3CH_2MgI + C_6H_5CHO ⟶ $C_6H_5CH(OH)C_2H_5$
d. CH_3CH_2MgI + $(C_6H_5)_2C{=}O$ ⟶ $(C_6H_5)_2C(OH)C_2H_5$

35. The reaction of propylene oxide with *excess* concentrated HCl yields

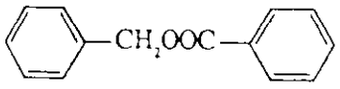
a. 1-chloro-2-propanol
b. 2-chloro-1-propanol
c. 1,2-dichloropropane
d. 1-chloro-1-propane

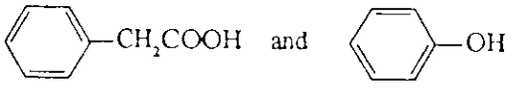
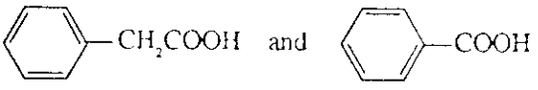
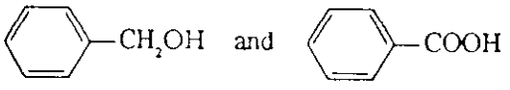
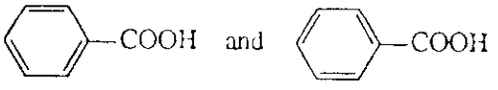
36. Rank the following compounds in decreasing acidity

A hydrocyanic acid ($pK_a = 9.31$)
B chloroacetic acid ($pK_a = 2.85$)
C phenol ($pK_a = 9.89$)
D lactic acid ($pK_a = 3.86$)

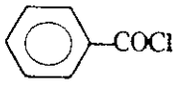
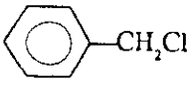
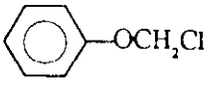
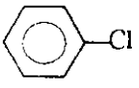
a. A > B > C > D
b. B > D > A > C
c. C > A > D > B
d. D > B > A > C

37. Which are the hydrolysis products of the following compound



a. 
c. 
b. 
d. 

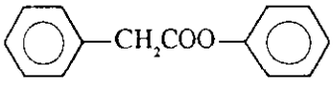
38. Which of the following compound is benzoyl chloride?

a. 
b. 
c. 
d. 

39. Which of the following is hydrolyzed the slowest by base?
a. $(CH_3CH_2CO)_2O$
b. CH_3CH_2COCl
c. $CH_3CH_2CONH_2$
d. $CH_3CH_2COOCH_3$

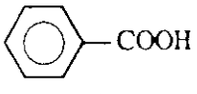
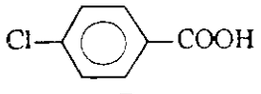
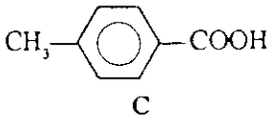
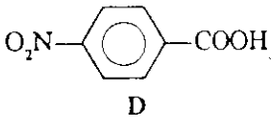
40. Carboxylic acids are _____ acids than alcohols because _____.
a. stronger; the carboxylate anion is destabilized by resonance
b. stronger; the carboxylate anion is stabilized by resonance
c. weaker; the alkoxide anion is more basic because of the alkyl group's inductive effect
d. weaker; the carboxyl group is more stabilized by resonance than the carboxylate anion

41. What is the name of this compound?



a. benzyl benzoate
b. phenyl benzoate
c. phenyl phenylacetate
d. benzyl phenolate

42. What is the correct descending order in acid strength of the following compounds?


A

B

C

D

a. A > D > C > B
b. B > A > D > C
c. C > D > A > B
d. D > B > A > C

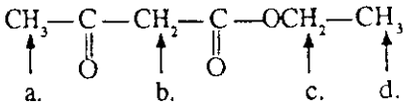
43. What is the product of the reaction of $HOCH_2CHO$ with C_2H_5MgBr?
a. $C_2H_5CH(OH)CH_2OH$
b. $C_2H_5OCH_2CHO$
c. $C_2H_5CH(OH)CHO$
d. C_2H_6

44. The reaction below produces a(n) _____.

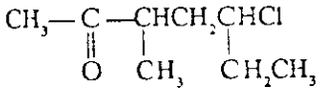
$$C_6H_5CHO + CN^- \xrightarrow{H_2O/H^+}$$

a. optically active compound
b. racemic pair
c. *meso* compound
d. a pair of diastereomers

45. Which are the most acidic hydrogens in the compound below?



46. The IUPAC name of the compound below is



a. 1-chloro-1,3-dimethyl-4-pentanone
b. 5-chloro-3-methyl-2-heptanone
c. 5-chloro-3,5-dimethyl-2-hexanone
d. 3-chloro-5-methyl-6-heptanone

47. Which is the weakest base?
a. N-methylaniline b. benzylamine c. aniline d. cyclohexylamine

48. In the synthesis of aniline from nitrobenzene, aniline can be separated from unreacted nitrobenzene by using an extraction procedure that involves ether and _____.
a. water b. aqueous HCl c. aqueous NaOH d. aqueous $NaHCO_3$

49. Which compound reacts with benzenesulfonyl chloride to give a product that is insoluble in basic *and* acidic medium?
a. N-methylaniline b. pyridine c. aniline d. N,N-dimethylaniline

50. Which procedure removes the amino group from aniline?
a. diazotization and acidification with dilute H_2SO_4
b. reduction with $LiAlH_4$ or H_2/Ni
c. reduction with Sn/HCl
d. diazotization and further reaction with H_3PO_2

ANSWER SHEET

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First Name _____

ID No _____

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