جامعة دمياط
كلية العلوم
قسم الكيمياء

جامعة دمياط
Damietta University

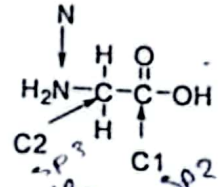
الفصل الدراسي :الأول (2024/ 2025)
المقرر : كيمياء ميكانيكية التفاعلات + التربينات)
الفرقة: المستوي الرابع (البرامج المزدوجة)

تاريخ الإمتحان : 2025/1/12
زمن الامتحان: ثلاث ساعات
الدرجة الكلية : 120 درجة

(الاختبار فى اربع صفحات)

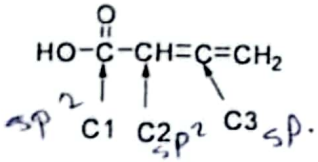
The Following Question must be answered

1. Which set of approximate bond angles at C1, C2, and N of the following molecule indicates the correct shape?



a) C1 120°, C2 120°, N 120°
b) C1 109.5°, C2 120°, N 109.5°
c) C1 109.5°, C2 120°, N 120°
d) C1 120°, C2 109.5°, N 109.5°

2. Which set of hybridization states of C1, C2, and C3 of the following molecule is correct?

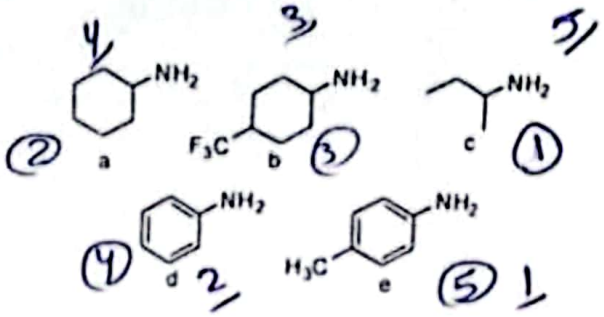


a) sp2, sp2, sp2
b) sp2, sp2, sp
c) sp3, sp2, sp
d) sp3, sp2, sp2

3. Why is an sp hybridized C-H bond stronger than an sp^2 C-H bond?
4. Are the hydrogen atoms in the molecule $H_2C=C=C=CH_2$ in the same plane or in planes perpendicular to each other? Explain using the hybridization of each carbon atom.
5. State whether the following statements is True or False?

i. Inductive effect is the ability of an atom or a group of atoms to cause polarization of electron density along the covalent bond so that the atom of higher electronegativity becomes electron deficient.
ii. The –OH group cannot exhibit Inductive effect.
iii. Inductive effect can be responsible for the dipole moment in a molecule.
iv. All alkyl groups exhibit –I effect.

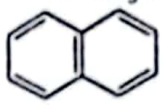
6. Rank the following compounds according to the increase of basicity?



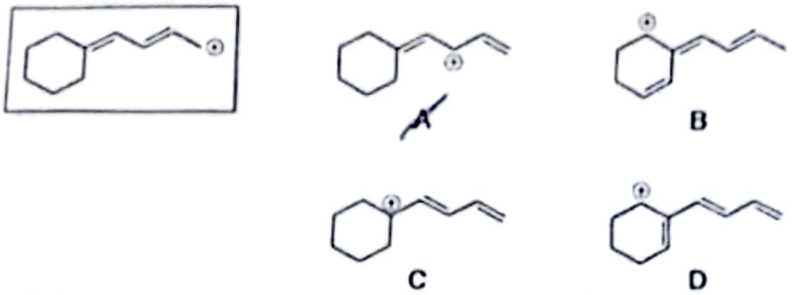
7. Which of the following alkyl halides would undergo S_N2 reaction most rapidly?

a. CH_3CH_2-Br
b. CH_3CH_2-I
c. CH_3CH_2- Cl
d. CH_3CH_2-F

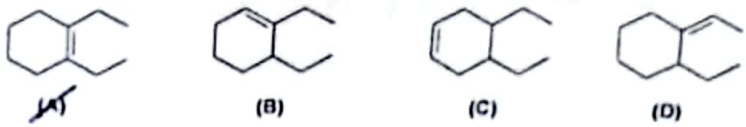
8. Draw the major resonance contributors of the following compounds.



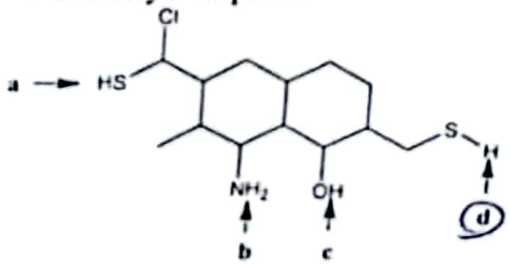
9. Which of the following structures represent resonance structures of the compound in the box?



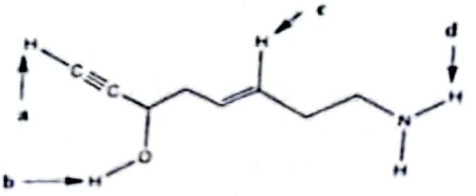
10. Which of the following compounds is the most stable?



11. If the molecule below were reacted with a strong base, which proton would the base react with preferentially? Explain.



12. Rank the indicated protons in the molecule below from most acidic (1) to least acidic (4).



13. Which of the following compounds is the most stable?

3,4-dimethyl-2-hexene; 2,3- dimethyl-2-hexene; 4,5-dimethyl-2-hexene.

14. Arrange the following nucleophile (HO^-, CH_3COO^-, PhO^-, CH_3O^-) in the decreasing order of reactivity with Benzyl chloride.

15. Account for the fact that pyrrole is much less basic than pyrrolidine.

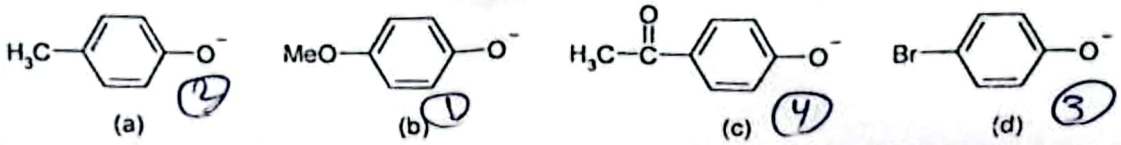
16. Which of the following best describes the mechanism of the Williamson ether synthesis (RX + R'ONa → R-O-R')?

a) S_N1 reaction
b) E^2 reaction
c) S_N2 reaction
d) nucleophilic acyl substitution

17. Which of the following species is the most stable?

a) *p*- $O_2N\,C_6H_4\,C^+H_2$
b) $C_6H_5\,C^+H_2$
c) *p*- $Cl\,C_6H_4\,C^+H_2$
d) *p*- $CH_3O\,C_6H_4\,C^+H_2$

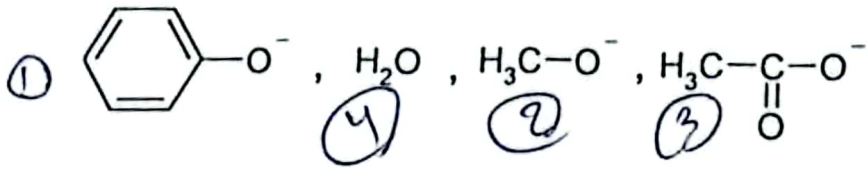
18. Rank the following anions in order of decreasing basicity.



19. Arrange the following compounds in an increasing order of acidity.

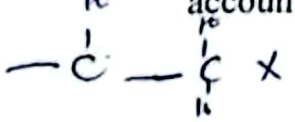
1) $OHC\,CH_2\,CHO$
2) $CH_3\,CO\,CH_2\,CO\,CH_3$
3) $EtOOC\,CH_2\,COOEt$
4) $CH_3\,CO\,CH_2\,CO_2Et$

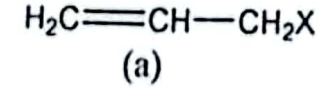
20. Arrange the following nucleophile in decreasing order of reactivity toward *methyl chloride*:-

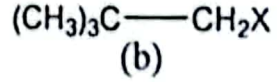


Second Question:-

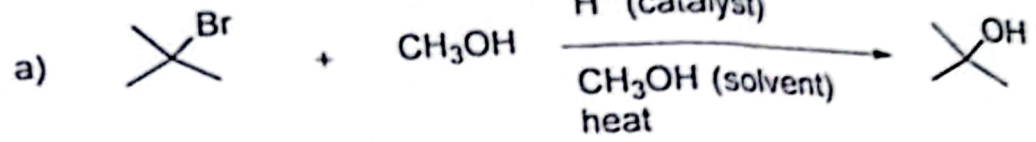
1. The following primary halides apparently undergo S_N1 type reactions, while most primary halides do not. Can you give reasonable explanation that will account for this?

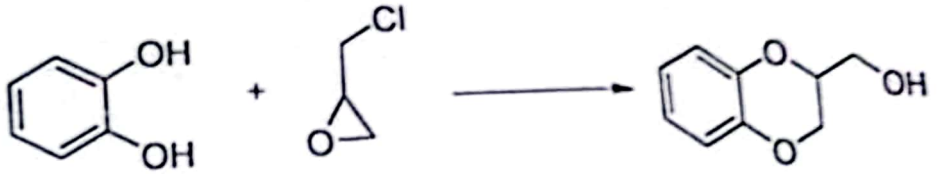


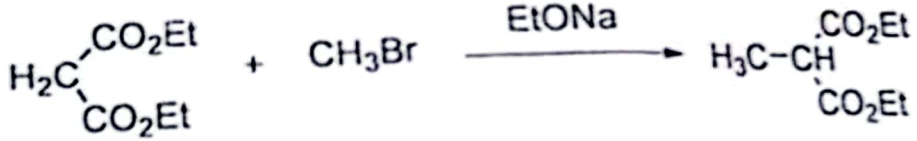

(a)


(b)

2. Which would you expect to be the stronger nucleophile:-
   a) The amide ion (NH_2^-) or ammonia (NH_3)?
   b) The ethoxide ion (EtO^-) or ethanol (EtOH)?
   c) The hydroxide ion (HO^-) or water?
3. Write step by step mechanisms that account for the major product of the following:

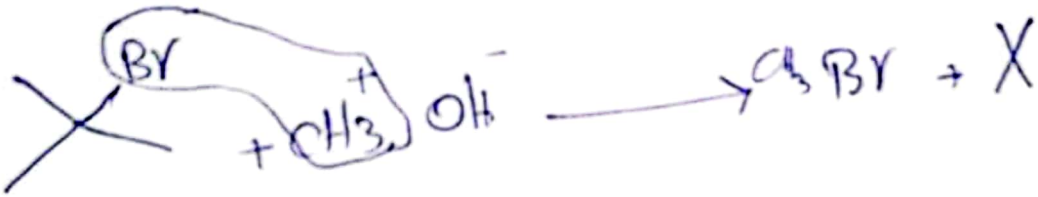
a) 

b) 

c) 

With my best wishes

Dr. Mamdouh Sofan
Prof. of organic chemistry

a) 

Section B: Terpenoids **Dr. Ahmed Hassan Eissa (45 Marks)**

Q1) Choose the correct answer for the following questions *(15 marks, 1.5 marks each)*

1) The shikimic acid pathway:

a) starts with acetyl SCoA

b) starts with phosphoenolpyruvate and erthrose-4-phosphate

c) produces steroids as final products

d) produces sesquiterpenes as final products

2) The precursors of sesquiterpenes are:

a) Geranyl PP

b) Geranylgeranyl PP

c) Farnesyl PP

d) Squalene

3) The mevalonic acid pathway produces:

a) Rubber

b) Alkaloids

c) Fatty acids

d) Isopentenyl PP

4) The precursors of diterpenes are:

a) Squalene

b) Geranylgeranyl PP

c) Farnesyl PP

d) Geranyl PP

5) The santolinyl skeleton is a biogenetic product resulting from the cleavage of:

a) Chrysanthemic acid

b) Protostane

c) Farnesol

d) Geraniol

6) The number of isoprene units in triterpenes is:

a) 1

b) 3

c) 6

d) 4

7) Citral in an example of:

a) Sterols

b) Diterpenes

c) Sesquiterpenes

d) Monoterpenes

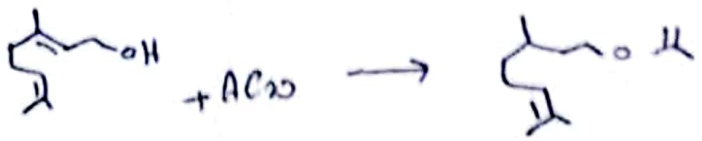
8) Geraniol ($C_{10}H_{18}O$), upon acetylation by Ac_2O, produces an acetate ester compound. This indicates

a) Geraniol has double bonds

b) Geraniol has an active alcoholic OH group

c) Geraniol is a monoterpene

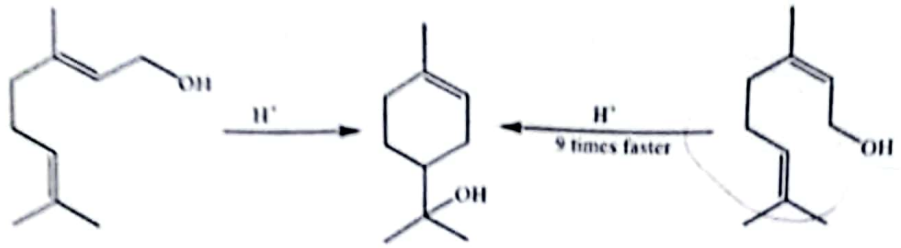
d) None of the above



9) Carvone ($C_{10}H_{14}O$), upon reaction with NH_2OH, produces an oxime compound. This indicates:

a) Carvone has two double bonds
b) Carvone is a monocyclic terpene
c) Carvone has an active carbonyl group
d) None of the above

10) In the following biogenetic intramolecular cyclization reactions:



Geraniol B α-terpineol Nerol A

Cyclization A is 9 times faster than cyclization B because:

a) Geraniol has a cis double bond
b) Nerol has an active OH group
c) Nerol has a cis double bond
d) None of the above

Q2) Write the structural elucidation of the following terpenes: *(15 marks, 5 marks each)*

1- Citral using NH_2OH, Na(Hg)/EtOH, Ac_2O, and alk.$KMnO_4/H_2SO_4$
2- Geraniol using Ac_2O, PhCOCl, dil.H_2SO_4/heat, H_2/Pt, and Br_2
3- α-Terpineol using Ac_2O, $KHSO_4$, Br_2, H_2SO_4/ heat, and $KMnO_4/CrO_3$

Q3) Illustrate the biogenesis or synthetic conversions of the following using chemical equations:

(15 marks, 5 marks each):

1. Conversion of acetyl-SCoA to isopentenyl PP
2. Mechanism of the conversion of nerol or geraniol to α-terpineol
3. Conversion of *p*-toluic acid to α-terpineol

********** *With my Best Wishes* **********

Dr. Ahmed Hassan Eissa