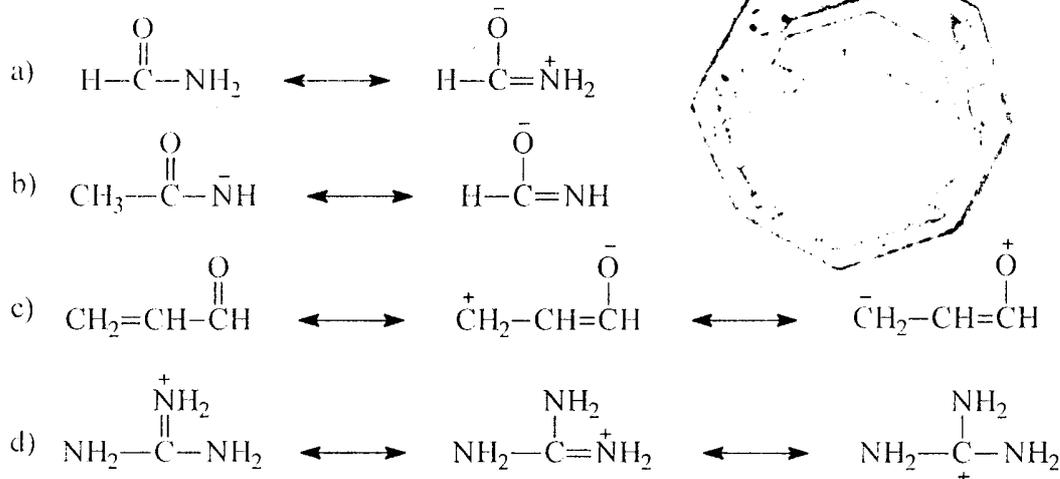


الإمتحان يتكون من ثلاثة أسئلة في أربع صفحات

Use the attached periodic table when necessary

Question No. 1 (25 Points)

A. For each of the following resonance hybrids, rank contributing structures in order of their relative stability



B. Arrange the following nitrogenous compounds in an increasing order of conjugate acid stability



C. Arrange the following covalent bonds in order of increasing polarity and indicate the direction of the bond moment, if any.

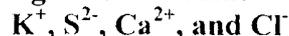


D. For the following, indicate the species in each row that has the desired property

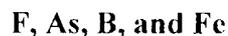
a) largest first ionization energy



b) largest ionic radius



c) most exothermic electron affinity



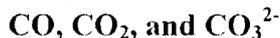
d) smallest effective nuclear charge



e) most electronegative



f) shortest C-O bond



E Indicate the compound with the highest boiling point in each pair.

a) $C(CH_3)_4$ and $C^3-(CH_2)_3-CH_3$ b) H_2S and H_2O

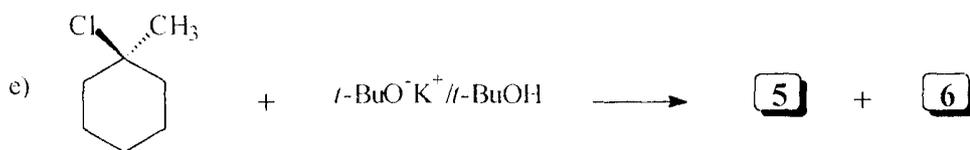
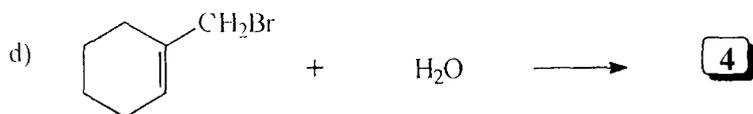
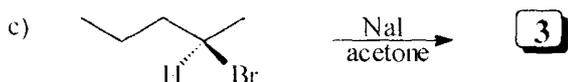
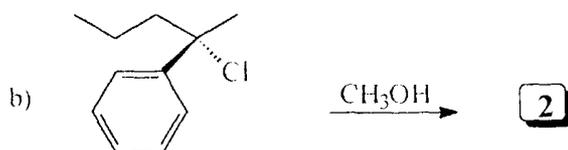
c) $CH_3CH_2-O-C^3$ and $CH_3CH_2CH_2OH$ d) NH_3 and $PI-1_3$

Question No. 2 (23 Points)

A. Draw the structures of the product indicating the reaction mechanism among the following reactions.

B. Metallic sodium can react with 4-chloro-1-butanol through an acid-base reaction. The product can undergo a subsequent internal nucleophilic substitution reaction. Predict the chemical structure of the final product.

C. For each of the following, state if the operating mechanism is S_N1 , S_N2 , $E1$, or $E2$, or if the mechanism can't be determined from the given data. Reaction is: $R-X + Y^-$ to give the product



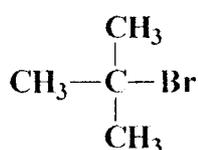
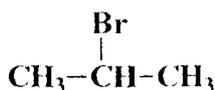
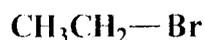
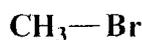
a) Rate = $[Y^-][R-X]$

b) Optically active R-X gives racemic R-Y

c) $CH_3CH_2(CH_2)_2X$ gives predominantly $CH_3CH=CHCH_3$ d) Reactant is CH_3X

e) Isopropyl iodide and isopropyl chloride give propene at the same rate

1). For each of the following four molecules, list the properties from the list on the right which describe it. Each item on the list can be used as often as necessary, or not at all.



- a. forms the least stable carbocation upon loss of bromide ion
- b. S_N1 reaction very facile
- c. contains no sp³ carbon atom
- d. capable of E1 reaction to form an alkene
- e. whether S_N1 or S_N2 mechanism is solvent-controlled
- f. incapable of an elimination reaction
- g. completely planar
- h. S_N2 reaction is essentially impossible
- i. S_N2 reaction is very facile
- j. undergoes E2 reaction to form an alkene

Question No. 3 (32 Points)

A. Draw the structure of the following

1-All Fischer projection of 2,4-dichlorobutanedioic acid (HOOC-Cl-CH-Cl-COOH):

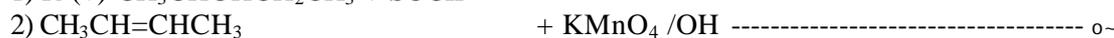
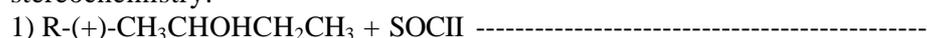
a) Indicate which of these structure are meso.

b) Indicate erythro or threo symbol to these structure.

c) Pair them into racemate and explain, how you can separate it. d) Assign (R) & (S) configuration to only one stereoisomer.

2- The most stable chair conformer of *trans* 1-chloro-3-methylcyclohexane 3-Chiral allene.

13. Complete the following equations with chemical structure, name the nature of the stereochemistry.



C. Discuss with equations the following:

2) Racemization reaction

3) Diels Alder reaction.

D. Give only one example to illustrate the following:

~' 1) 1,3-Diaxial interaction.

2) 1, 4- Addition reaction.

3) Optically active and optically inactive isomers of 1,2-dimethylcyclopropane.

∴ ~ s.

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y1

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L, JL

∴ Jt, J Best wishes with great success

