

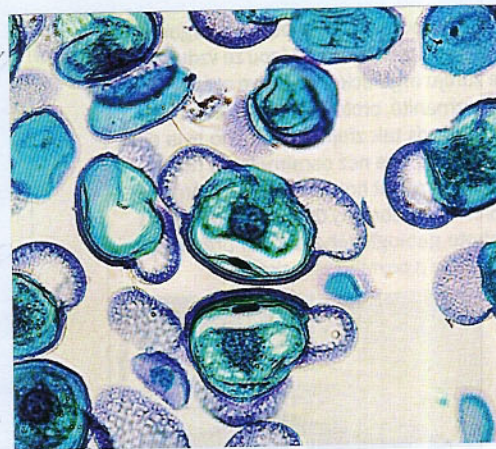


ΟΡΓΑΝΙΚΗ ΙΙ ΦΑΡΜΑΚΕΥΤΙΚΗ 2 ΕΤΟΣ

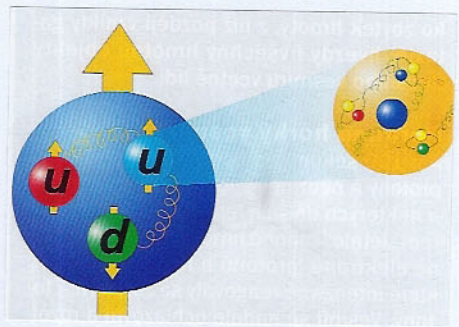
Δημοσιεύουμε τις 101 ερωτήσεις της **ΟΡΓΑΝΙΚΗΣ ΧΗΜΕΙΑΣ ΙΙ** για την **ΦΑΡΜΑΚΕΥΤΙΚΗ ΣΧΟΛΗ** του **COMENIUS**. Σταδιακά κάθε εβδομάδα θα δημοσιεύουμε τις ορθές απαντήσεις. Είναι όλα όσα απαιτούνται για τις εξετάσεις του 3^{ου} εξαμήνου για το μάθημα της **ΟΡΓΑΝΙΚΗΣ ΙΙ**

Η πρόσβαση είναι ελεύθερη στο site www.tomischool.gr στο εικονίδιο **SOS**.

ORGANIC CHEMISTRY II



- 1 Write the reaction of buta-1,3-diene with Br_2 at high temperatures.
- 2 Write the reaction of but-1-ene with Br_2 .
- 3 Write the reaction of but-1-ene with HBr .
- 4 Write the reaction of but-1-ene with HOBr .
- 5 Write the reaction of cyclohexene with H_2O in the presence of H^+ .
- 6 Write the reaction of propene with ozone, followed by the reaction with water.
- 7 Which product is obtained by reacting 1-bromobutane with KCN . Write the reaction's type.
- 8 Which alkene gives by ozonolysis acetaldehyde and propanone.
- 9 Write the reaction of nitrobenzene with mixture of nitric acid and sulfuric acid.
- 10 Write the reaction of phenol with mixture of nitric acid and sulfuric acid.
- 11 Write the reaction of ethylpropanoate with NH_3 .
- 12 Write the reaction of ethylpropanoate with ethyletanolate.
- 13 Write the mechanism of the reaction between butanoic acid and ethanol in presence of acid.
- 14 Write the reaction of pyridine with NaNH_2 and specify the type of the reaction.
- 15 Write the equation for the oxidation reactions of D-ribose and L-ribose with $\text{Br}_2 + \text{H}_2\text{O}$.
- 16 Write the mechanism of the reaction between ethylbutanoate and water in the presence of sulfuric acid.
- 17 By reduction reaction of nitrobenzene A is obtained. A reacts with HNO_2 and gives B. Write the reactions and give the A and B products.
- 18 Propose a method for preparation of 2-nitrofurane and 2-bromopyrrole.
- 19 Write the reaction of pyridine with KOH and specify the type of this reaction.
- 20 Write the reaction of quinoline with NaNH_2 and specify the type of this reaction.
- 21 Write at least three different methods for the preparation of aldehydes, ketones, alcohols, halogen derivatives, carboxylic acids, alkenes, alkynes.
- 22 Write the reaction of 2 molecules of acetaldehydes in the presence of hydroxide.
- 23 Compare the reactivity of the following carbonyl compounds in the reaction with the nucleophilic agent:
acetone(propanone) formaldehyde(methanal) acetaldehyde(ethanal)
- 24 Write the mechanism of the reaction of 2 molecules of benzaldehyde in the presence of HO^- (Cannizzaro reaction).



- 25 Write the reaction of **propanal** with **phenylhydrazine**.
- 26 Write the reaction of **propanal** with **aniline** (phenylamine).
- 27 Write the reaction of **acetaldehyde** (ethanal) with **hydroxylamine**.
- 28 Prepare **1-ethylbutan-2-ol** by reacting the corresponding carbonyl compound with a Grignard reagent.
- 29 Write the reaction of **chloroethane** with sodium hydroxide and specify the type of the reaction.
- 30 Compare the reactivity of the following alkyl halides with KCN in S_N1 reactions:
allylchloride methylchloride propylchloride
- 31 Write the mechanism of the reaction of **ethylbromide** with **sodium cyanide**.
- 32 Write the elimination reaction for **2-bromobutane**. Write all the products and specify which one is the major product.
- 33 Prepare **pentan-2-ol** by reacting the corresponding carbonyl compound with a Grignard reagent.
- 34 **Phenylmethylketone** gives in the reaction with NH_2OH , 2 products A and B which have the same molecular formula (C_8H_9NO). By Beckmann rearrangement, B (as Z isomer) is converted to **N-methylbenzenecarboxamide**. Write the equations of these reactions.
- 35 Prepare **ethyl-4-nitrobenzenecarboxylate** from **benzene**.
- 36 Prepare **4-chlorotoluene** (4-chloro-1-methylbenzene) from **benzene**.
- 37 **2-Propylpentanoic acid** (valproic acid) is an effective drug for the treatment of several types of epilepsies. Propose a synthetic pathway of valproic acid starting from **diethylmalonate** (diethylpropanoate).
- 38 Write the mechanism of the reaction between **1-chloropropane** and **KOH**.
- 39 Write the mechanism of the reaction between **chlorocyclohexane** and **KCN**.
- 40 Write the mechanism of the reaction between **benzene** and Cl_2 in the presence of $AlCl_3$.
- 41 Write the mechanism of the reaction of **benzene** with SO_3 .
- 42 Write the mechanism of the reaction of **benzene** with Br_2 .
- 43 Write the reagents and reaction's conditions in the preparation of the following compounds, starting from **but-1-ene**:
a) butan-2-ol
b) butan-1-ol
c) but-2-ene.
- 44 Write the reagents and reaction's conditions in the preparation of the following compounds, starting from **phenol**:
a) 2-nitrophenol
b) sodium phenoxide
c) 2,4,6-tribromophenol.

45 Write the reaction scheme for the preparation of the following compounds starting from benzene:

- a) 3-bromophenol
b) 1,3-diaminobenzene.

(Several steps are required!!!)

46 Prepare aniline (phenylamine) from toluene (methylbenzene).

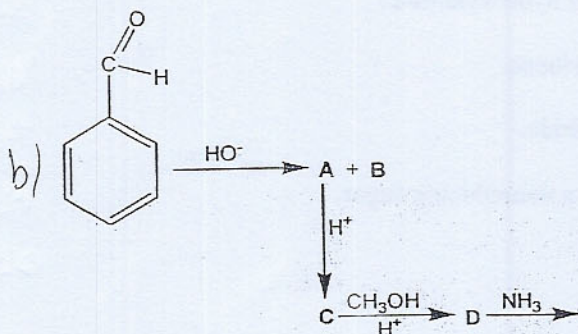
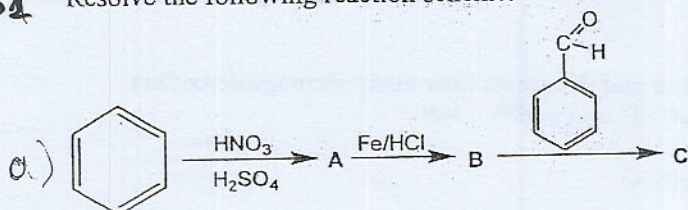
47 Prepare 3-cyanobenzoic acid from benzene by using Sandmeyer reaction.

48 Prepare 2,2-phenyl-2-hydroxyacetic acid starting from benzaldehyde.

49 Prepare N-phenylcarboxamide from phenylethanone (by Beckmann rearrangement).

50 By reacting (R)-2-chlorobutane with sodium butanolate a product with (S)-configuration is obtained. Write the reaction and explain the mechanism.

51 Resolve the following reaction scheme:



52 Write the mechanism of the reaction of propene with HCl.

53 Write the mechanism of the reaction of but-1-ene with H₂O.

54 Write the mechanism of the reaction of propanal with ethanol in the presence of H⁺.

55 Write the mechanism of the reaction of butanal with HCN in the presence of CN⁻.

56 Write the mechanism of the reaction of butanonoxime with water in the presence of H⁺ (Beckmann rearrangement).

57 Write the mechanism of the hydrolysis reaction of benzenecarbonitrile, catalyzed by sulfuric acid.



58 Write the mechanism of the reaction of ethylbenzenecarboxylate with excess of ethylmagnesiumbromide.

59 Write the mechanism of the S_N1 reaction between pentan-1-ol and $SOCl_2$.

60 Draw the structures of the following alkyl halides and arrange them in the order of increasing of reactivity in respect with S_N1 mechanism. Explain your answer:
benzylchloride tert-butylchloride ethylchloride isopropylchloride
allylchloride vinylchloride

61 Write the oxidation product of cyclohexanol with CrO_3 .

62 Draw the Fischer projection of glucose, fructose, ribose and determine how many stereogenic centers exist in these structures.

63 Draw the Haworth projection of glucose, fructose, ribose and determine how many stereogenic centers exist in these structures. 2^c (c = number of asymmetric C).

64 Write the oxidation products of glucose, fructose and ribose.

65 Write the reactions of glucose and fructose with 3 molecules of hydroxylamine.

66 Write the products obtained by reduction of D-glucose and D-ribose.

67 Write the reaction of D-glucose with 5 molecules of acetic anhydride.

68 Draw the structure of sucrose and specify if it is a reducing or a nonreducing sugar.

69 Draw the structures of the following steroids:

5 α -gonane and β -gonane

estra-1,3,5(10)-triene

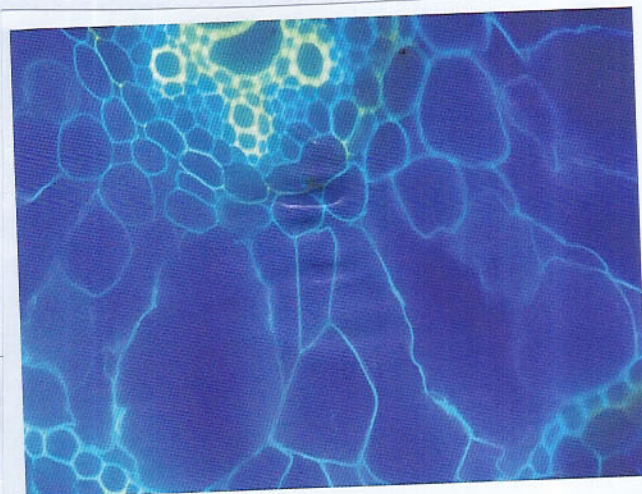
5 α -andros-1-ene-17 β -ol (write also the reaction of this one with Br_2)

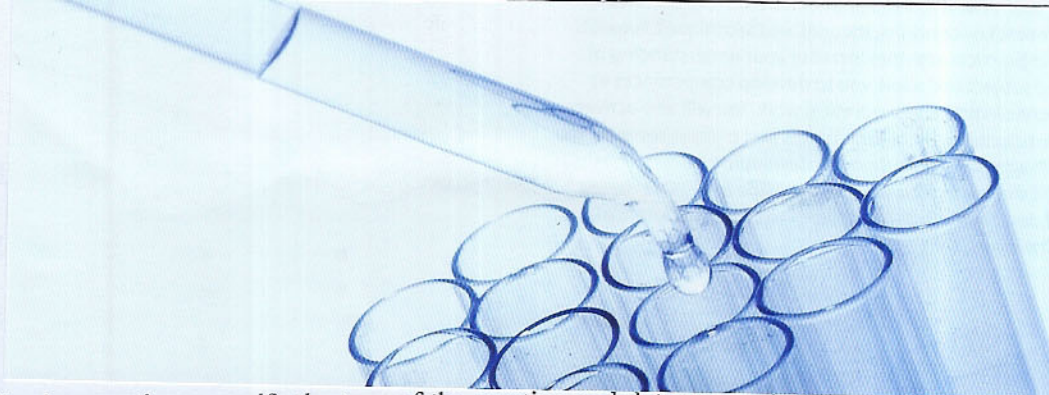
21-hydroxy-5 α -pregna-1,4-diene-3-one (write the reaction of this one with hydroxylamine, aniline and hydrazine)

5 β -choles-5(6)-ene-3 β -ol (write the reaction of this one with $SOCl_2$).

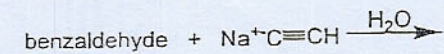
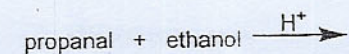
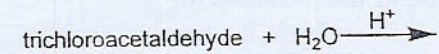
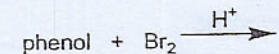
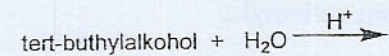
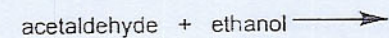
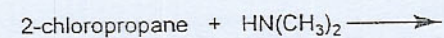
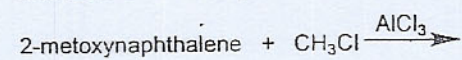
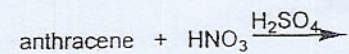
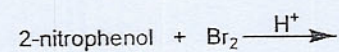
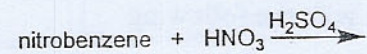
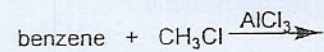
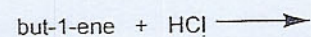
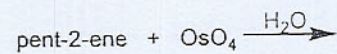
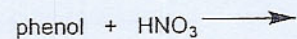
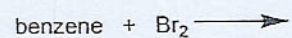
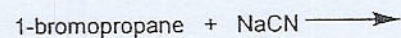
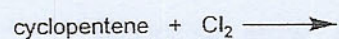
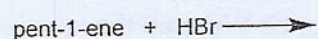
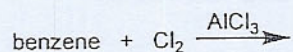
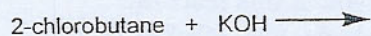
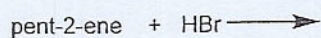
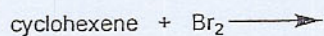
70 Benzaldehyde reacts with acetic anhydride in the presence of sodium ethanoate (sodium ethoxide, as catalyst) and forms A as a product. A reacts further with bromine to give B. Write the reaction's scheme and determine the products A and B.

71 Prepare ethylbenzenecarboxylate from benzene.

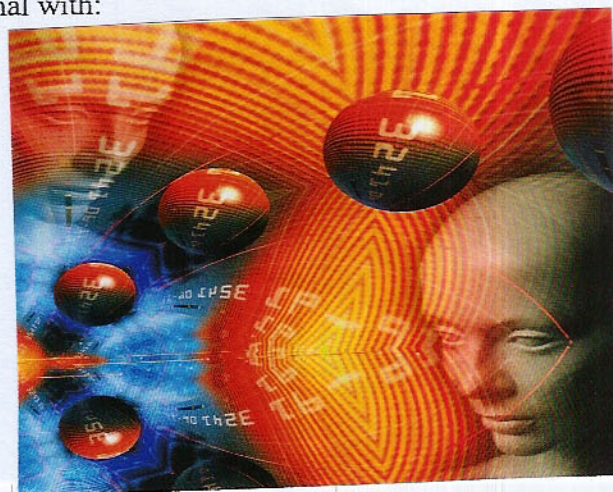




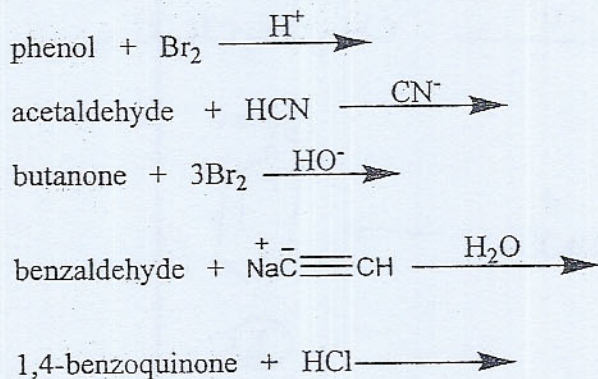
79 Write the equations for the following reactions, specify the type of the reaction and determine which one is the substrate, which is the reagent and write the product:



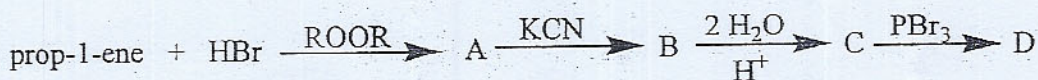
- 73 1. Write the reaction of but-1-yne with water in acidic medium and specify the type of the mechanism.
- 74 2. Write the product, which results in the reaction of bromocyclohexane with NaCN. Name the product and specify the type of the mechanism.
- 75 3. Which alkene gives by ozonolysis benzaldehyde and propanal? Write the reaction of the corresponding alkene with ozone, followed by reaction of intermediates with water.
- 76 4. Write the nitration reactions of:
a) benzoic acid and
b) ethylbenzene
with nitric and sulfuric acids mixture. Write the type of the mechanism.
- 77 5. Write the reaction of propanoic acid with SOCl_2 and specify the type of this reaction.
- 78 6. Write the mechanism's steps of the reaction between acetaldehyde and ethanol in acidic medium.
- 79 7. 1-Nitronaphtalene is reduced (with $\text{Fe} + \text{HCl}$) to product A, which by diazotation (with HNO_2) forms product B. Compound B reacts with CuCl to form C. Write all the reactions.
- 80 8. Prepare 2-nitrofurane from furane and 2-bromopyrrole from pyrrole. Write the special reagents used in these reaction.
- 81 9. Write the reactions of pyridine with:
a) NaNH_2
b) CH_3Li
Write the type of the reactions and name the products thus formed.
- 82 10. Write the chemical equations for the following reactions:
a) oxidation of ribose with $\text{Br}_2 + \text{H}_2\text{O}$
b) reduction of ribose with NaBH_4
- 83 11. Write the Fischer projection of glucose and the Haworth formula as glucopyranose and show the number of the stereogenic centers in both of the forms.
- 84 12. Write the chemical equation of 3β -hydroxy- 5β -androstan-17-one with the following reagents:
a) hydroxylamine
b) methylmagnesium bromide, followed by reaction with water.
- 85 13. Write the equation of the reaction of diazomethane with:
a) acetaldehyde (ethanal)
b) acetic acid.
- 86 14. Write at least three different methods for alcohol's synthesis.
- 87 15. Write the chemical equation of Claisen condensation of ethylacetate (ethyl ethanoate) in the presence of sodium metanolate. Write the name of the final product.
- 88 16. Write the structures and compare the reactivities of the following carbonylic compounds, towards the nucleophilic agents:
Propanoylchloride Ethyl propanoate Propanamide Potassium propanoate
- 89 17. Write the mechanism of Canizzaro reaction of benzaldehyde in the presence of sodium hydroxide.
- 90 18. Write the chemical equations for the reactions of propanal with:
a) aniline (benzenamine)
b) hydroxylamine
Write the type of the reactions.
- 91 19. Write the reaction of 5β -estra-3-ene with:
a) KMnO_4 at room temperature
b) Br_2 .



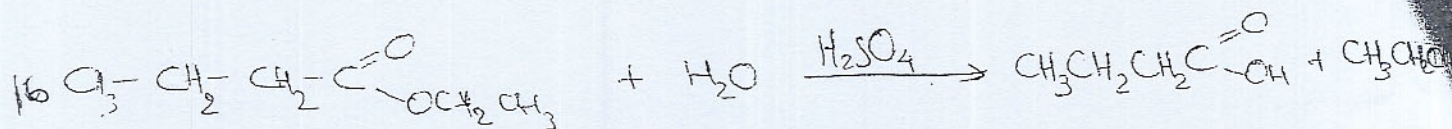
- 92 20. Draw the structure of maltose (disaccharide), obtained from two molecules of α -D-glucopyranose bent via 1-4 glycosidic bond. Determine if maltose is reductive or nonreductive carbohydrate.
- 93 21. Write the mechanism of the reaction, which occurs between benzene and methylchloride in the presence of AlCl_3 .
- 94 22. Write the chemical equation for the following reactions and specify the type of the reactions:



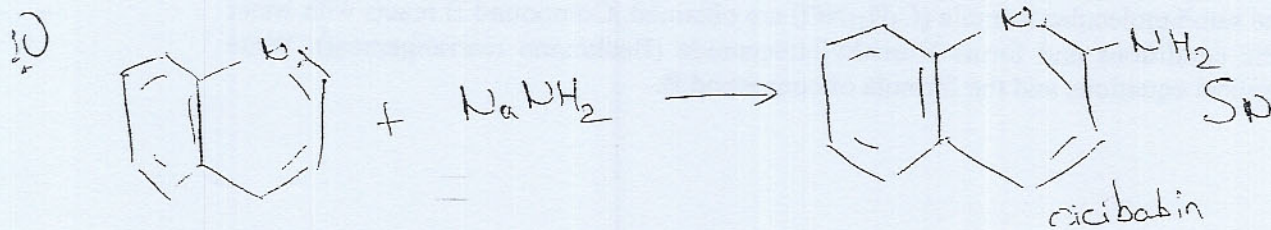
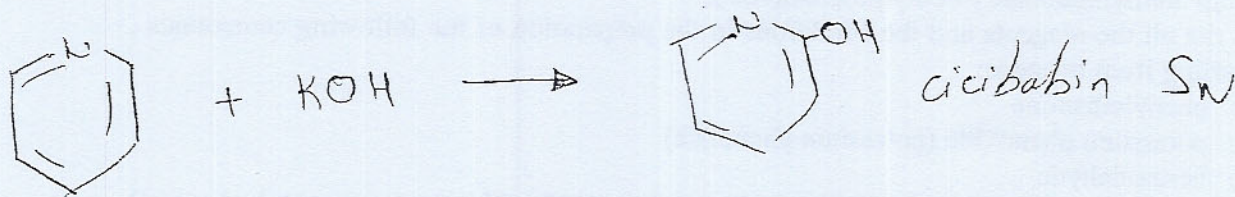
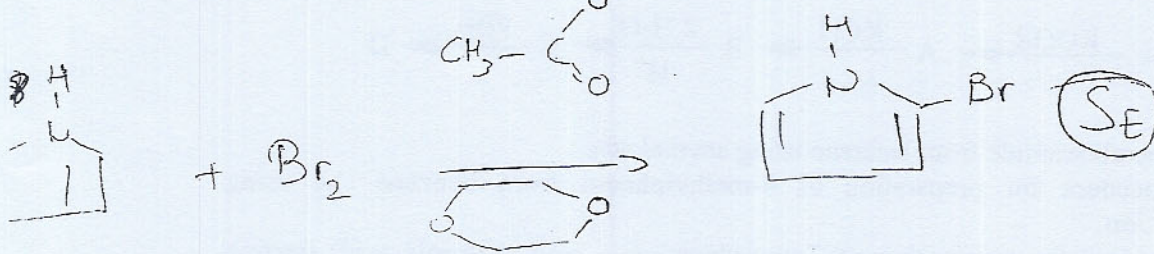
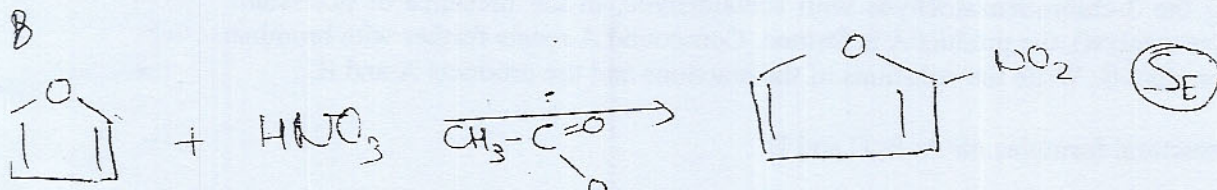
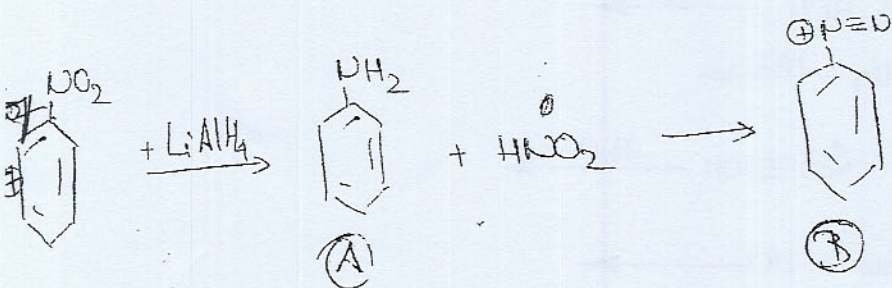
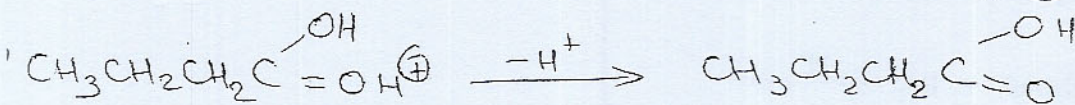
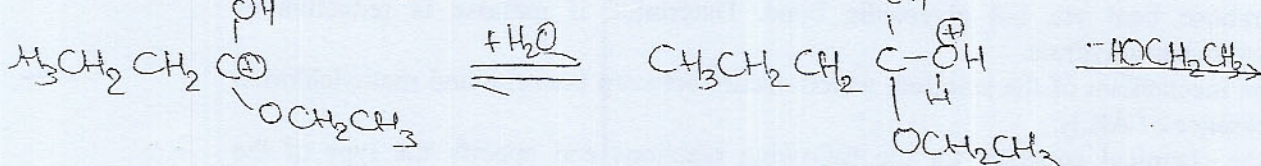
- 95 23. By reacting the 3-chlorobenzaldehyde with acetaldehyde, in the presence of potassium hydroxide (as catalyst), the product A is formed. Compound A reacts further with bromine and forms product B. Write the equations of the reactions and the products A and B.
- 96 24. Write the structural formulas for A, B, C and D:

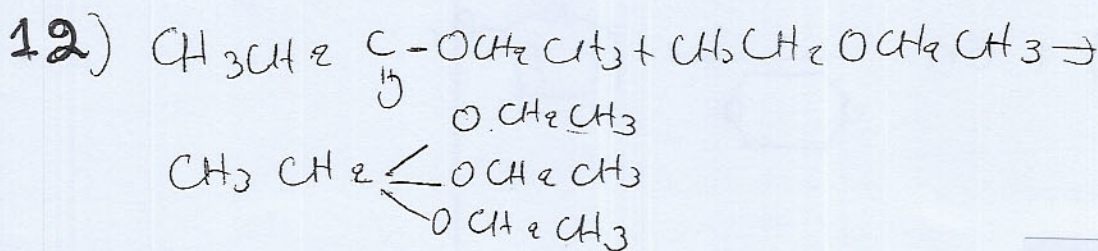
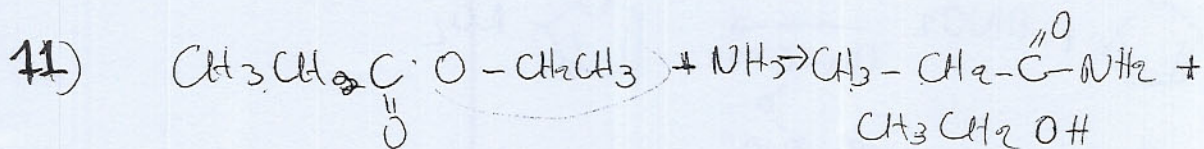
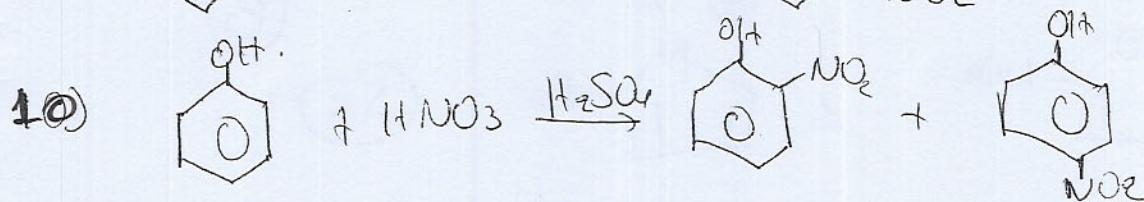
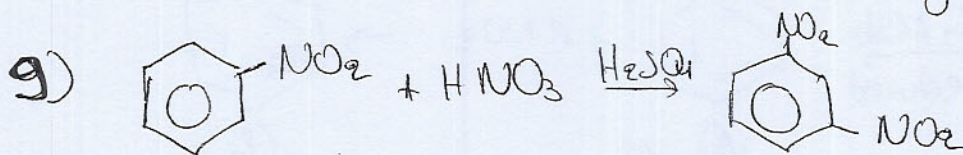
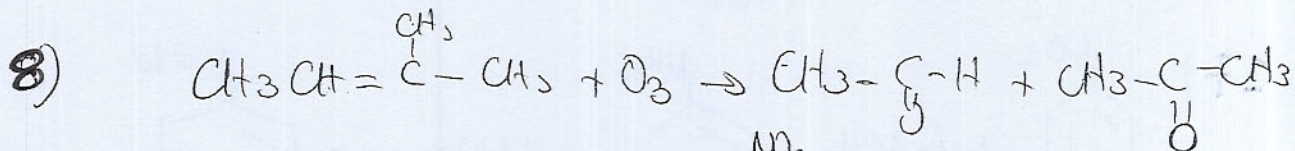
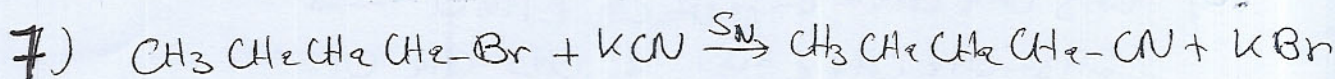
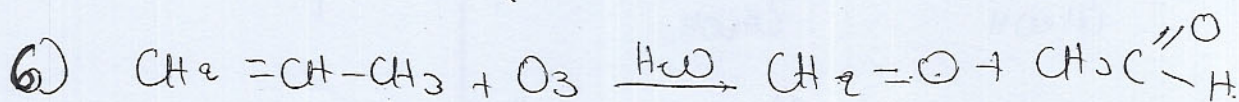
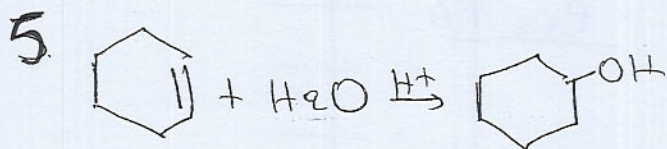
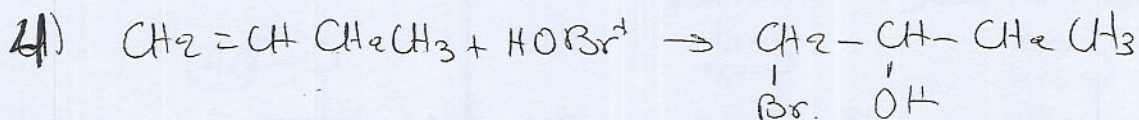
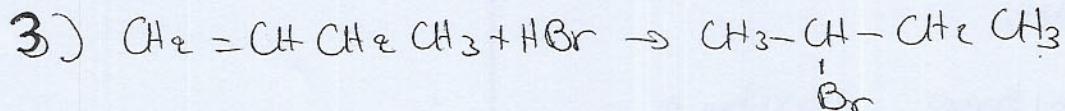
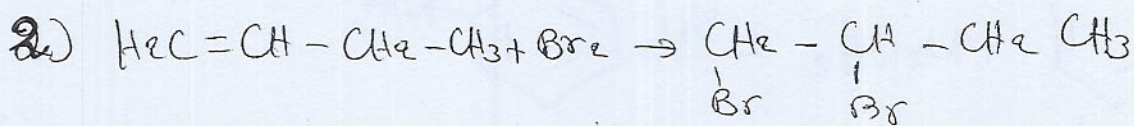
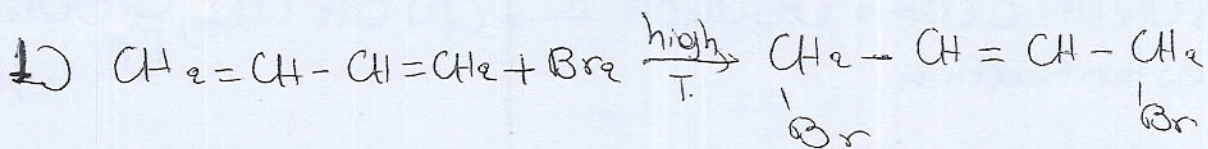


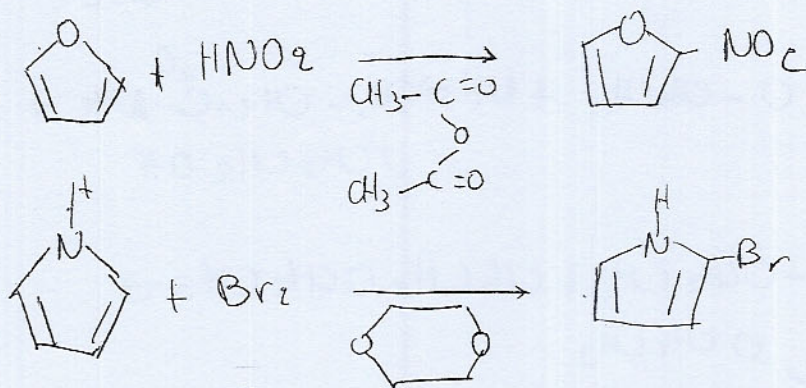
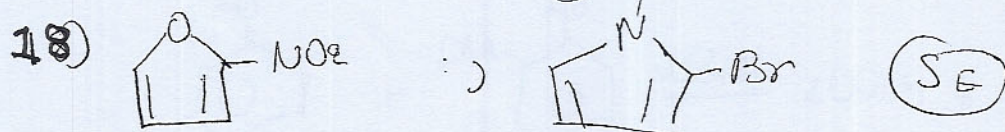
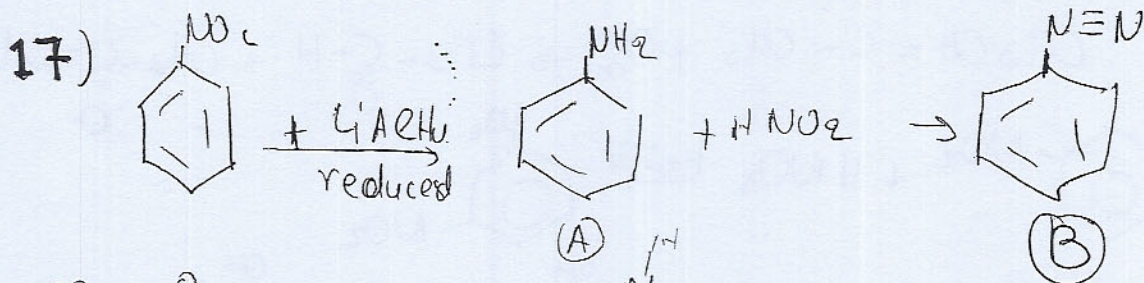
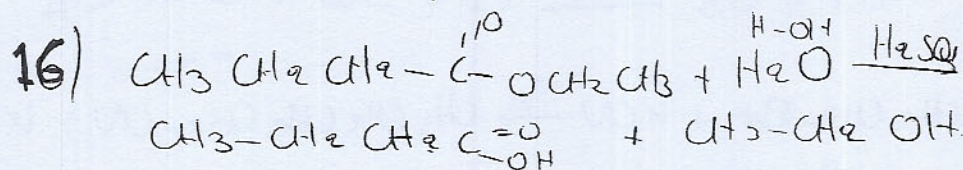
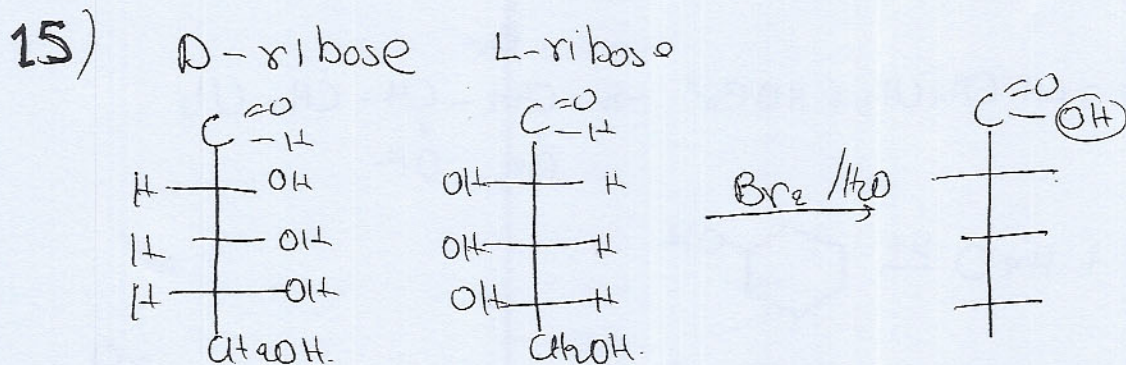
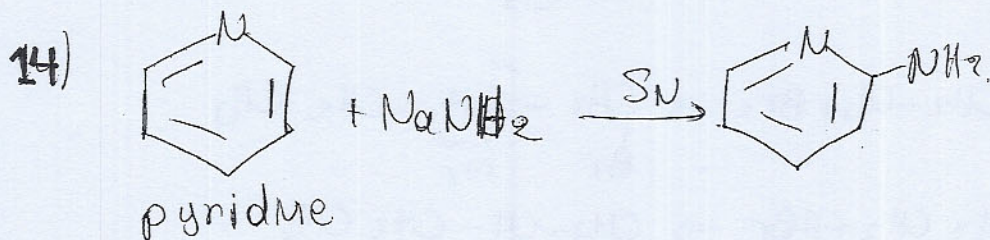
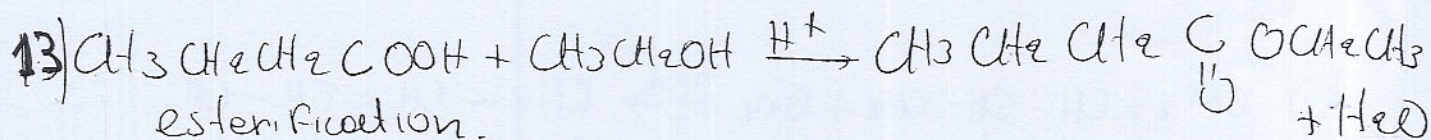
- 97 25. Prepare benzenecarboxamide from benzene using several steps.
- 98 26. Propose a procedure for preparation of 4-methylphenol from benzene and using diazotation reaction.
- 99 27. Propose a procedure for preparation of 2-propylpentanoic acid (valproic acid) starting from diethylmalonate (diethylpropandioate).
- 100 28. Write all the reagents and the conditions in the preparation of the following compounds, starting from benzene:
- phenylethanone
 - potassium phenoxide (potassium phenolate)
 - benzaldehyde
- 101 29. By reacting pentan-2-one (methylpropylketone) with NH_2OH , two compounds A and B with the same molecular formula ($\text{C}_5\text{H}_{11}\text{NO}$) are obtained. Compound B reacts with water in acidic conditions and forms N-methylbutanamide (Beckmann rearrangement). Write the chemical equations and the formula of compound B.



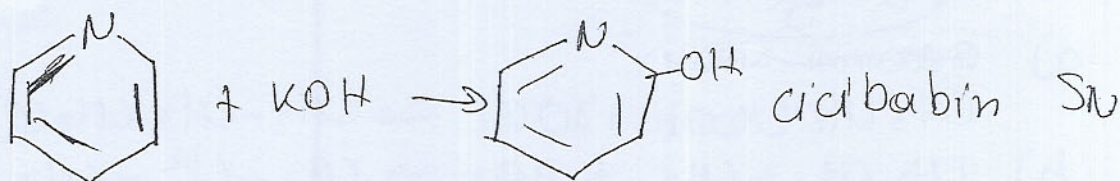
ism







19)



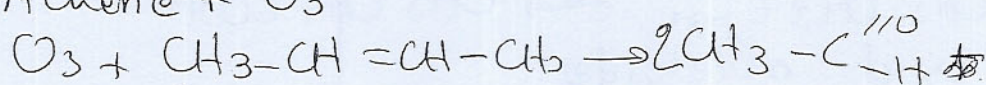
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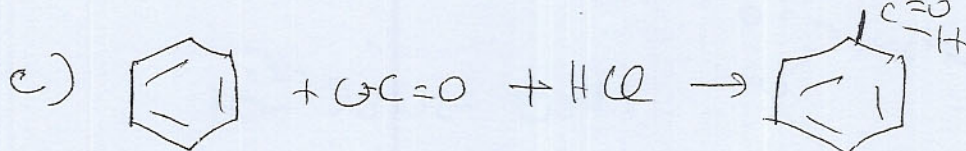
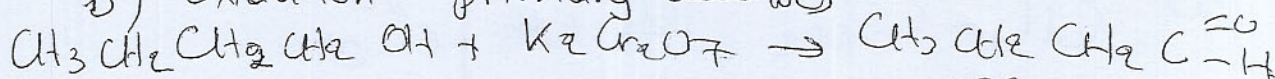
21)

Aldehydes

a) Alkene + O₃

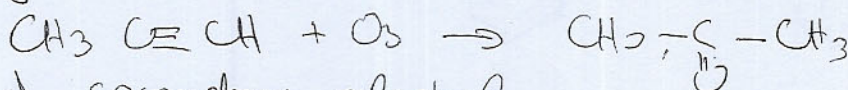


b) oxidation primary alcohols

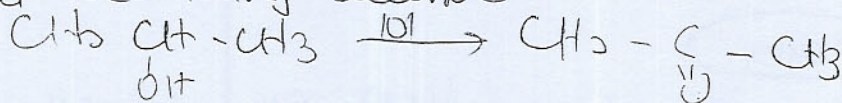


Ketones

a) Alkyne + O₃

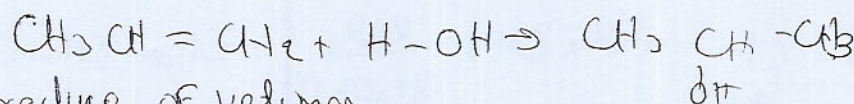


b) ox. secondary alcohol

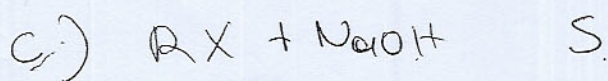


Alcohols

a) Alkene + H₂O



b) reduce of ketones



21

Halbogen.

- a) $CH_3CH_2CH_2OH + SOCl_2 \rightarrow CH_3CH_2CH_2Cl$
- b) $CH_3CH=CH_2 + HBr \rightarrow CH_3CH_2CH_2Br$
- c) $CH_3CH_2C(=O)H + SOCl_2 \rightarrow CH_3CH_2C(=O)Cl$

Carboxylic acids

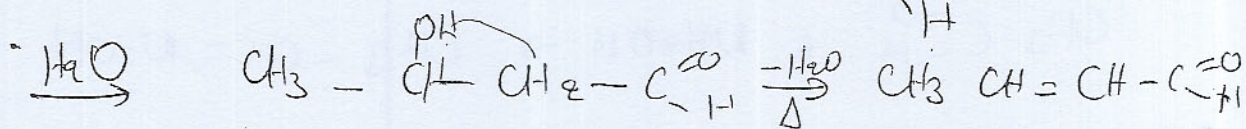
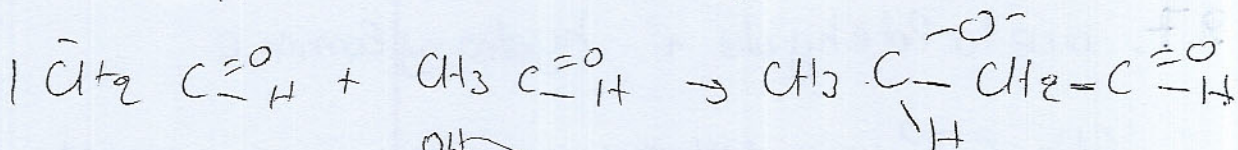
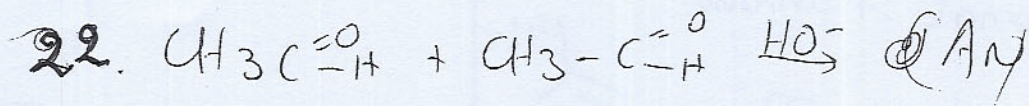
- a) $CH_3CH_2C(=O)H \xrightarrow{O} CH_3CH_2COOH$
oxid. aldehydes
- b) $CH_3C(=O)NH_2 \xrightarrow{H_2O} CH_3C(=O)OH$
- c) $CH_3C(=O)OCH_3 + H_2O \rightarrow CH_3C(=O)OH$
- d) $C_6H_5C(=O)H \xrightarrow{O} C_6H_5COOH$

Alkenes

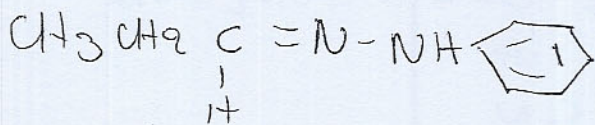
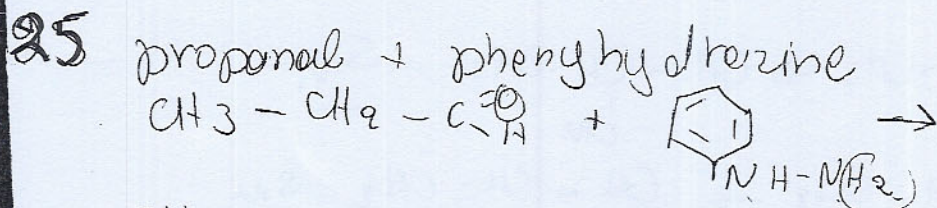
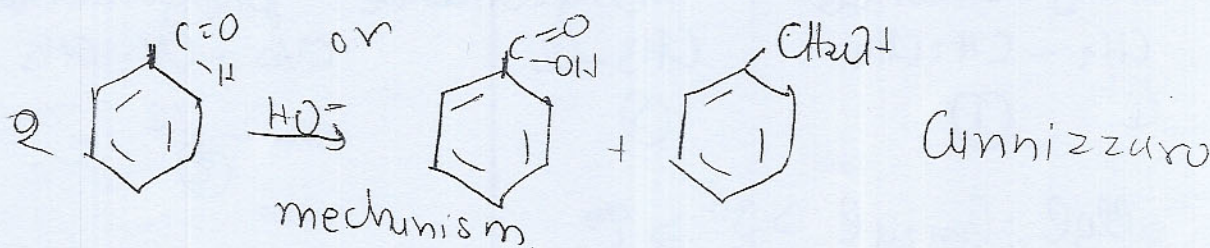
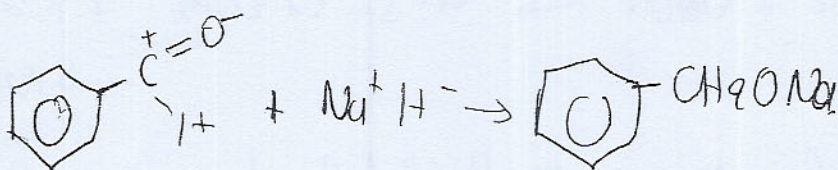
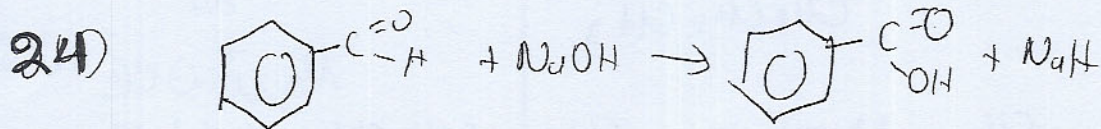
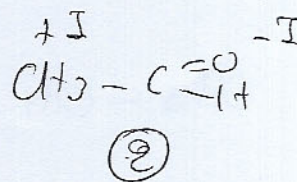
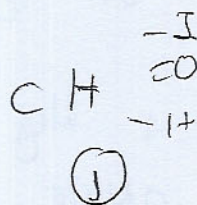
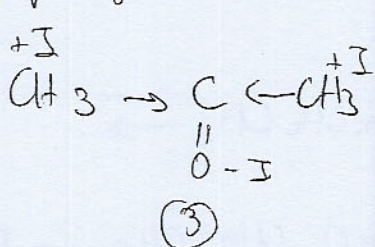
- a) $CH_3CH_2CH_2Cl \xrightarrow[25^\circ C]{H_2O} CH_3CH=CH_2$
- b) $CH_3CH(OH)CH_2CH_3 \xrightarrow{H_2SO_4} CH_3CH=CHCH_3$
- c) $CH_3CH(Br)CH_2CH_3 \xrightarrow[CH_3CH_2OH]{KOH} CH_3CH=CHCH_3$

Alkynes

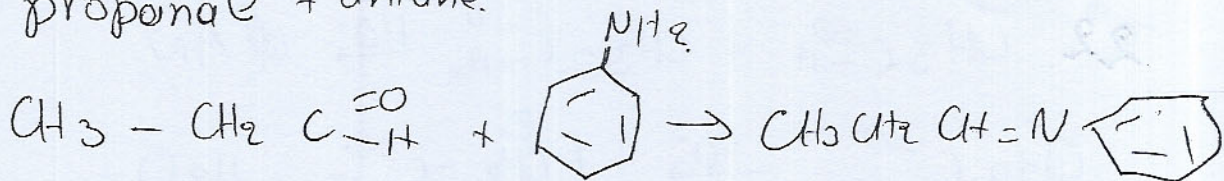
- a) $CH \equiv CH + MnNH_3 \rightarrow NaC \equiv CH \xrightarrow{CH_3I} CH_3C \equiv CH$
- b) $CH_2=CH-CH_3 \xrightarrow[-]{H_2} CH \equiv C-CH_3$
- c) $CH_3CH_2CH_2CH_3 \xrightarrow[alkohol]{KOH} CH_3CH=CHCH_3 \xrightarrow[OH^-]{KOH} CH_3C \equiv CCH_3$



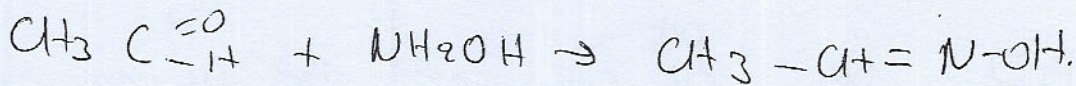
23. propanone



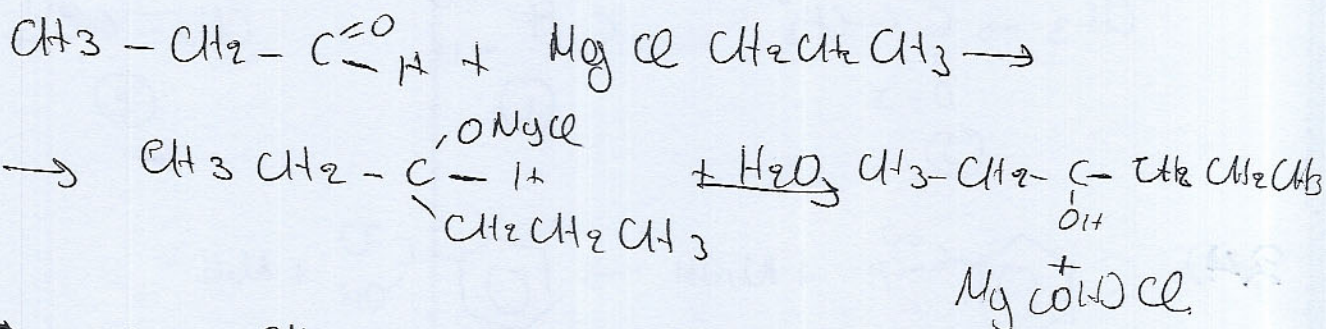
26. propionaldehyde + aniline.



27. acetaldehyde + hydroxylamine



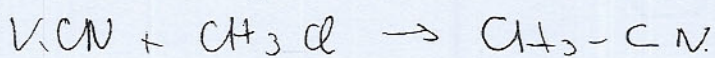
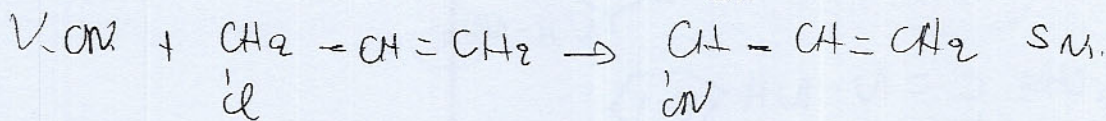
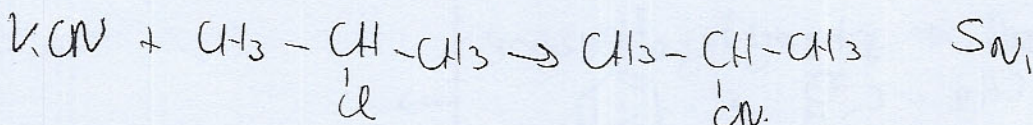
28. $\text{CH}_3 - \text{CH}_2 - \underset{\text{OH}}{\underset{\text{CH}_2\text{CH}_3}{\text{C}}} - \text{CH}_2$

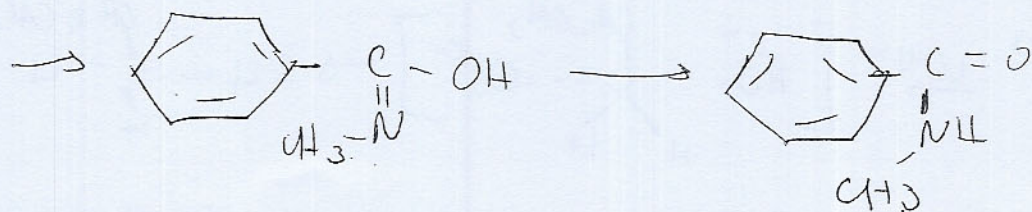
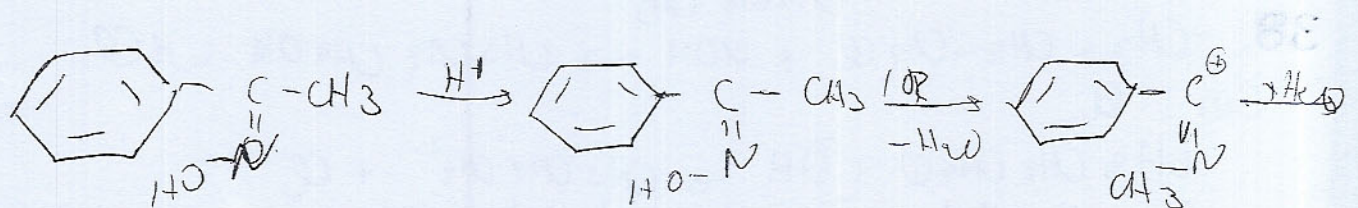
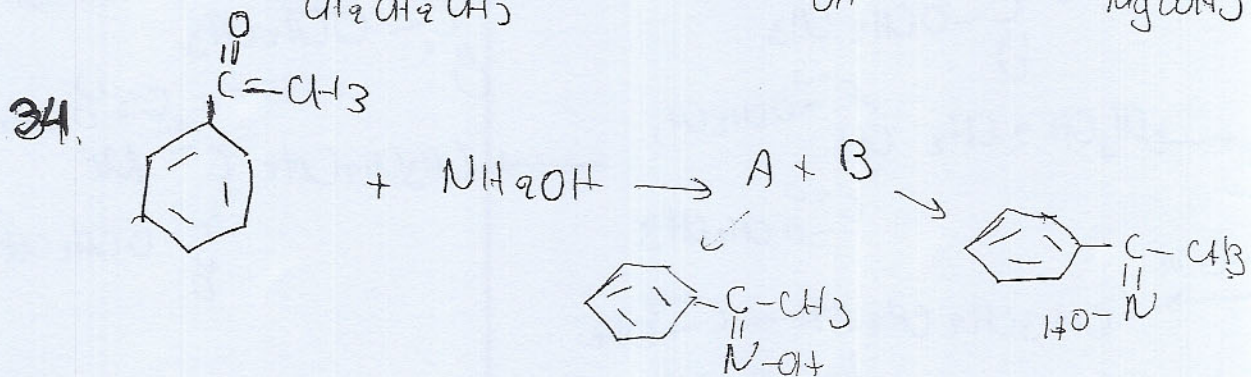
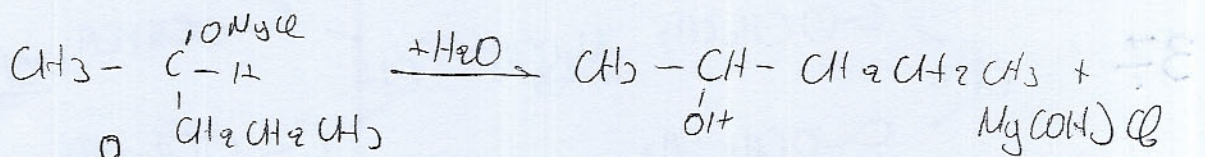
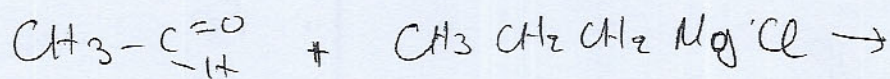
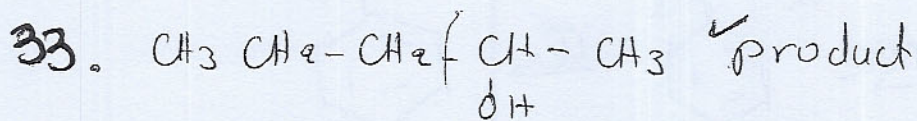
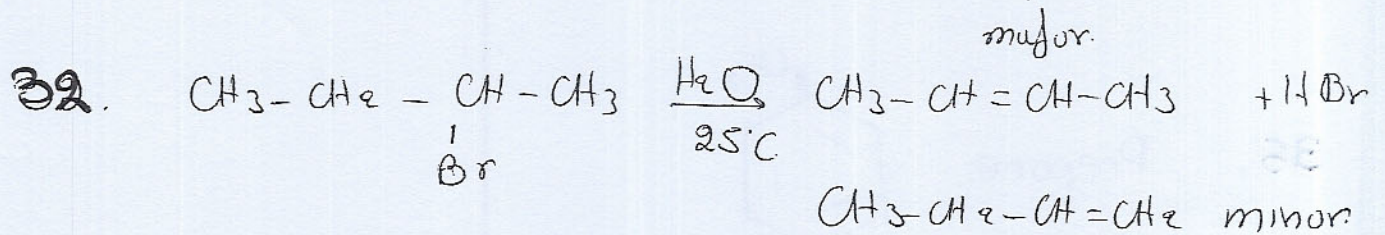
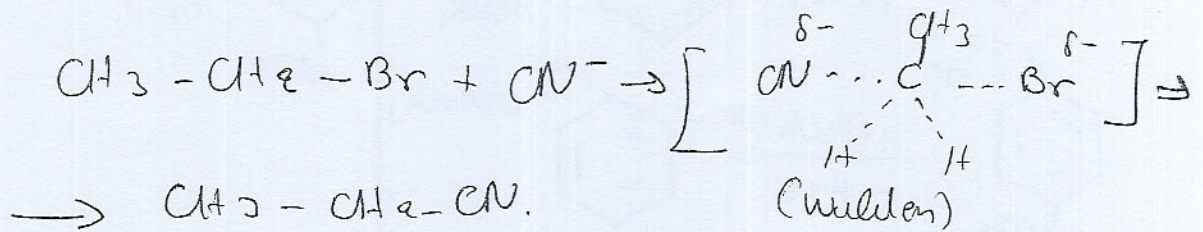


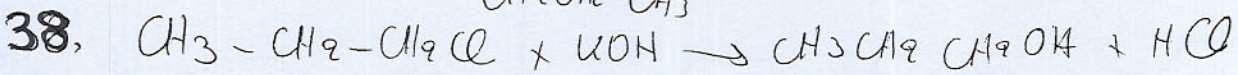
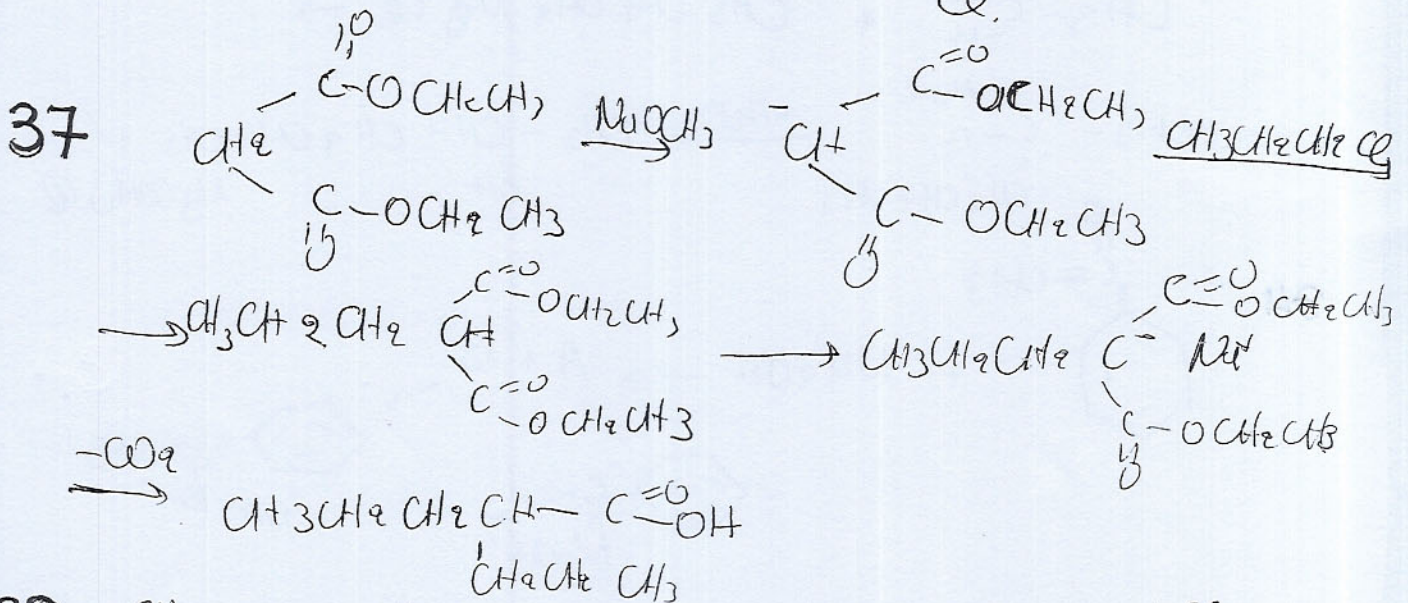
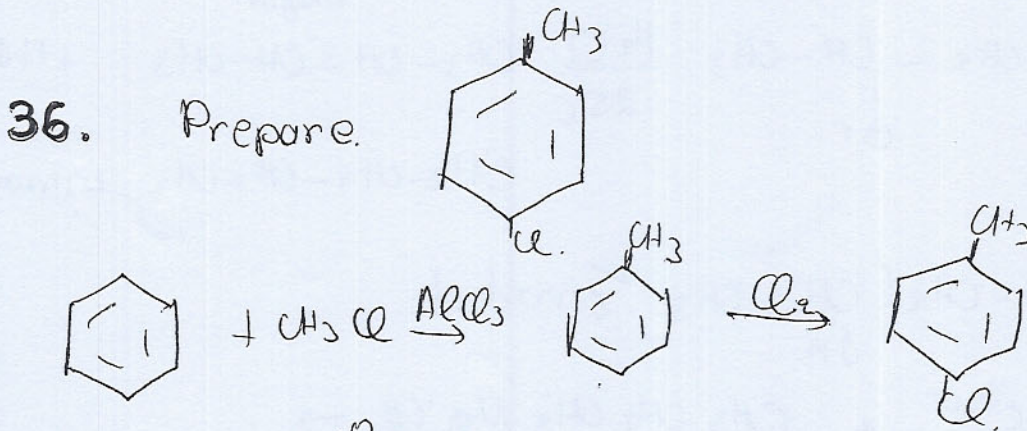
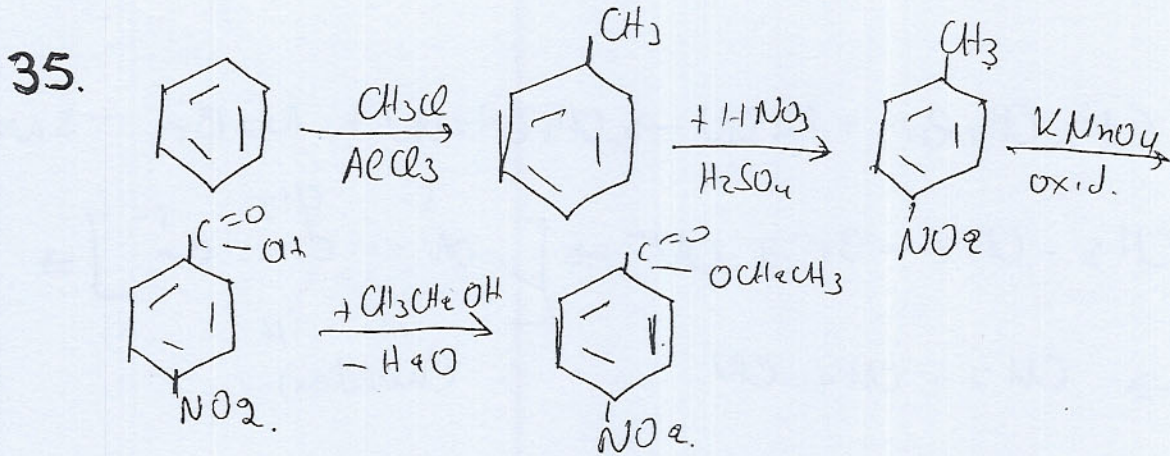
29. $\text{CH}_3 - \underset{\text{Cl}}{\text{CH}_2} + \text{NaOH} \rightarrow \text{CH}_3 - \text{CH}_2\text{OH} + \text{NaCl}$
S_N2

30. Allyl chloride (1) methyl chloride (3) propyl chloride (2)

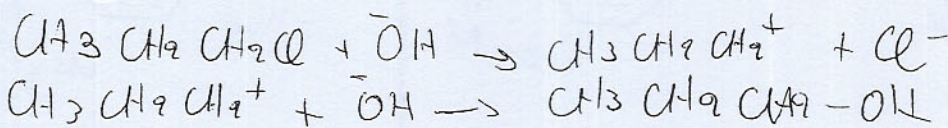
allyl ; benzyl > 3° > 2°







$\text{S}_{\text{N}}1$



$\text{S}_{\text{N}}2$

