Organic Chemisty Question

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Remark: This is a flowchart-type question, made by myself. Writing this down in typst is mostly for rememberance purposes.

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It contains concepts from Class XI and XII of Organic Chemistry.

Question

Consider the preparation of several reagents used:

$$\mathrm{FeSO_4} \xrightarrow{\Delta} \alpha \xrightarrow{\mathrm{HCl}} \mathrm{R_1} \tag{1a}$$

$$\mathrm{Ag + HNO_3} \xrightarrow{\Delta} \beta \xrightarrow{\mathrm{NH_3 + H_2O}} \mathrm{R_2} \tag{1b}$$

$$\mathrm{B_1} \xrightarrow{\mathrm{NaOH + Cl_2}} \mathrm{R_3} \tag{1c}$$

$$\mathrm{E} \xrightarrow{\mathrm{HIO_4}} \gamma \xrightarrow[\substack{\text{(iii) Mg, Dry Ether}\\ \text{(iv)}\mathrm{F_1},\mathrm{H^+}\\ \text{(v)}\mathrm{P_4O_{10}},\Delta}]{\substack{\text{(i)}\mathrm{NaBH_4}\\ \text{(ii) Red P},\mathrm{Br_2}}} \mathrm{R_4} \tag{1d}$$

In Equation 1a, α is the only solid product. In Equation 1d, γ is the product that has molecular weight equal to 30 g $\mathrm{mol^{-1}}$(Only the substance with this molecular weight is separated and subjected to the other reagents.)

Note that in the above equations, $\mathrm{B_1}$, E and $\mathrm{F_1}$ are products that are obtained in the following organic reactions. Compound A is 3,7-dimethylocta-2,6-dien-1-ol.

$$\mathrm{A} \xrightarrow{\text{Thionyl Chloride}} \mathrm{B} \xrightarrow[\text{(ii)}\mathrm{H^+/H_2O}]{\text{(i)PBA}} \mathrm{C} \xrightarrow[\text{(ii)}\mathrm{H^+/H_2O}]{\text{(i)Mg}} \mathrm{D} \xrightarrow{\mathrm{NaOH}} \mathrm{E} \xrightarrow[\mathrm{CH_2Cl_2}]{\mathrm{CrO_3\cdot\ py}} \mathrm{F} \xrightarrow[573\mathrm{K}]{\mathrm{Cu}} \mathrm{G} \xrightarrow[\mathrm{H^+/H_2O}]{\mathrm{MeMgBr + CuI}}$$

$$\cdots\mathrm{H} \xrightarrow[\mathrm{H^+/H_2O}]{\text{Peracetic Acid}} \mathrm{I} \xrightarrow{\mathrm{NaBH_4}} \mathrm{J} \xrightarrow{\Delta} \mathrm{K} \xrightarrow{\text{N-bromosuccinimide}} \mathrm{L}$$

Figure 1: Reaction Series 1

Consider another sequence of reactions:

$$\mathrm{H} \xrightarrow[\text{(ii)}\mathrm{Zn/H_2O}]{\text{(i)}\mathrm{O_3}} \underbrace{\mathrm{A_1 + B_1}}_{\text{mixture}} \xrightarrow[\Delta]{\text{Excess dil. NaOH}} \mathrm{C_1} \xrightarrow[\text{(excess)}]{\mathrm{SeO_2}} \mathrm{D_1} \xrightarrow{\mathrm{HIO_4}} \mathrm{E_1 + F_1}$$

$$\mathrm{E_1} \xrightarrow[\Delta]{\mathrm{NH_3}} \mathrm{G_1} \xrightarrow{\mathrm{NaOH + Br_2}} \mathrm{H_1} \xrightarrow{\mathrm{pH} = 3-4} \mathrm{I_1}$$

Figure 2: Reaction Series 2

Here, F_1 is a gaseous product(used in the preparation of reagent R_4 in Equation 1d). In the mixture $A_1 + B_1$, A_1 does not give the iodoform test, while B_1 gives yellow precipitate on reaction with $NaOH + I_2$.

Further,

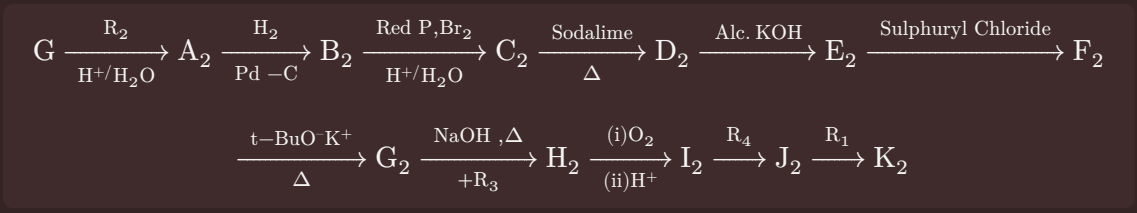


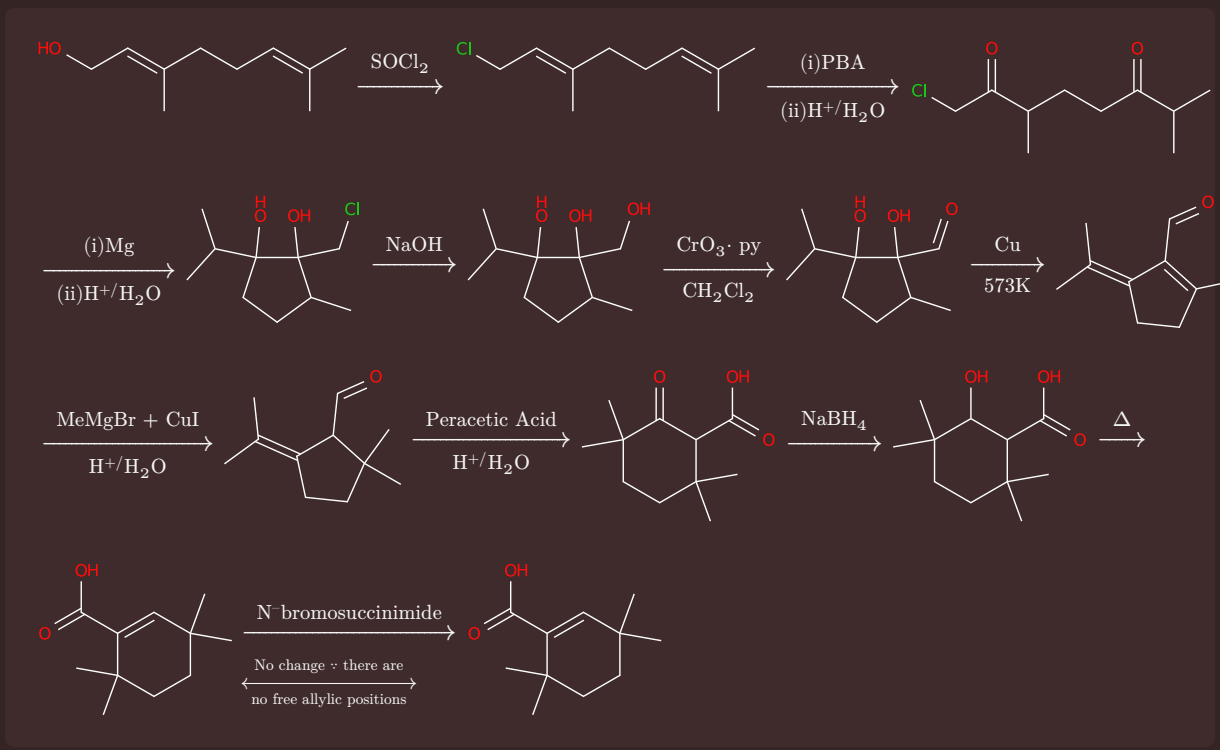
Figure 3: Reaction Series 3

Here, H_2 is a mixture of two major isomeric compounds. Hence, I_2, J_2, K_2 will also be a mixture of those isomers.

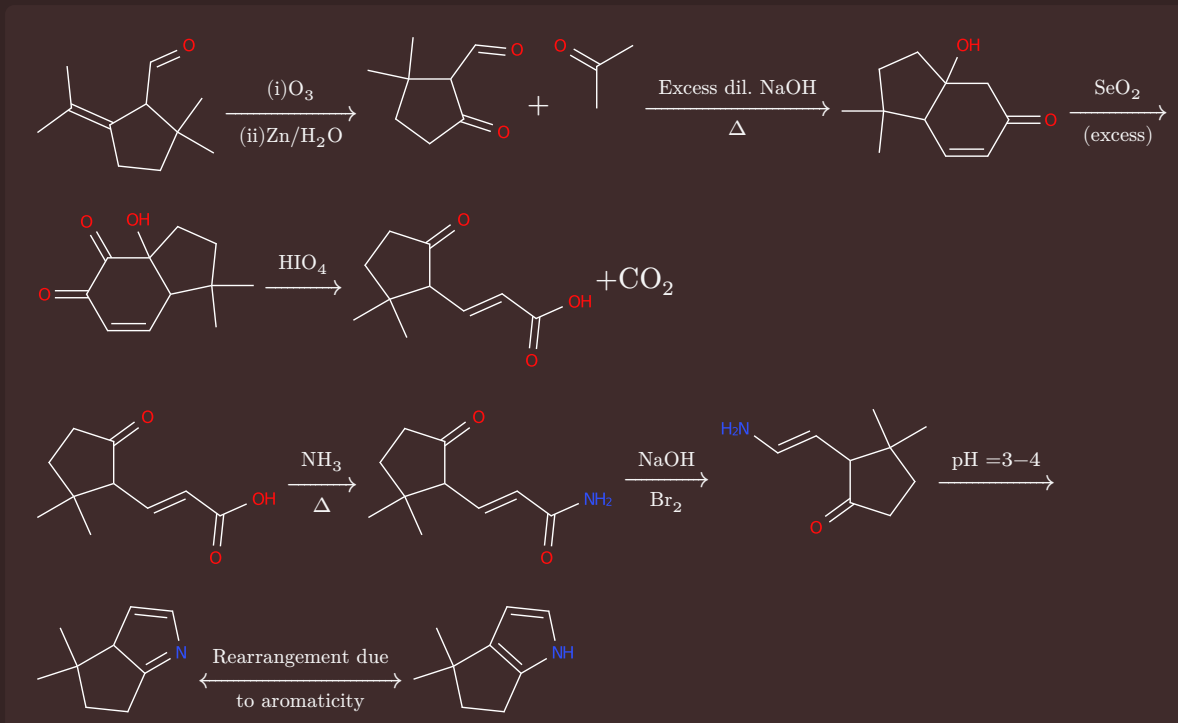
Identify the structures of compounds M, I_1, K_2 (a mixture). Also list all aromatic compounds formed.

Solution

Reaction Series 1:



Reaction Series 2:



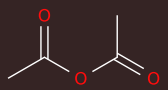
Now moving on to the inorganic reactions,

$$FeSO_4 \xrightarrow{\Delta} Fe_2O_3 \xrightarrow{HCl} FeCl_3 \tag{2a}$$

$$Ag + HNO_3 \xrightarrow{\Delta} AgNO_3 \xrightarrow{NH_3+H_2O} \left[Ag(NH_3)_2\right] \tag{2b}$$

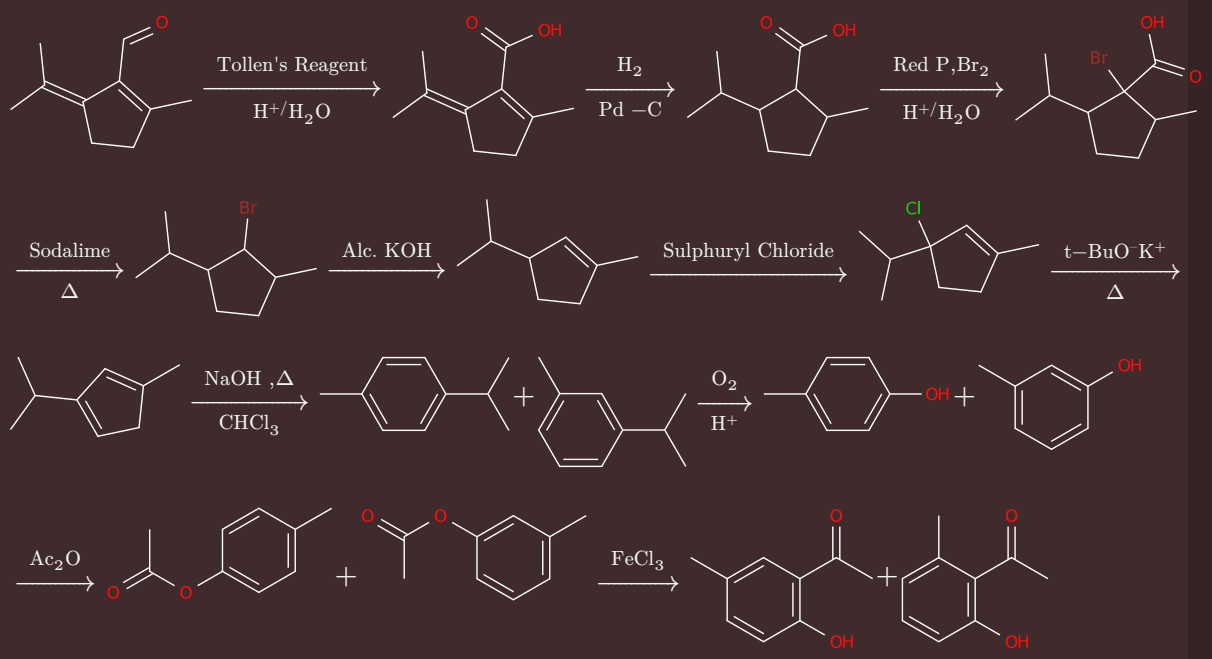
$$\xrightarrow{NaOH\ +Cl_2} CHCl_3 \tag{2c}$$

$$E \xrightarrow{HIO_4} HCHO \xrightarrow[\substack{(iii)\ Mg,\ Dry\ Ether\\ (iv)CO_2,H^+\\ (v)P_4O_{10},\Delta}]{\substack{(i)NaBH_4\\ (ii)\ Red\ P,Br_2}}$$



(2d)

Finally, Reaction Series 3: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Tollen's Reagent
H+/H2O
O
OH
H2
Pd –C
O
OH
Red P,Br2
H+/H2O
OH
Br
O
Sodalime
Δ
Br
Alc. KOH
Sulphuryl Chloride
Cl
t–BuO⁻K⁺
Δ
NaOH ,Δ
CHCl3
O2
H+
OH
OH
Ac2O
O
O
O
O
FeCl3
O
O
OH
O
OH