一、 **Supply the suitable reagents for the following conversion. (2 pts. each; 20 pts. total)**

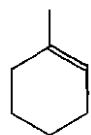

Benzene $\xrightarrow{A}$ [NO$_2$] $\xrightarrow{B}$ [NH$_2$] $\xrightarrow{C}$ [N$_2^+$ Cl$^-$] $\xrightarrow{D}$ [CN] $\xrightarrow{E}$ [COOH] $\xrightarrow{F}$ [COO$^-$ NH$_4^+$] $\xrightarrow{G}$ [CONH$_2$]

[CH$_3$] $\xrightarrow{H}$ [CH$_2$Br] $\xrightarrow{I}$ [CH$_2$OH] $\xrightarrow{J}$ [CHO]
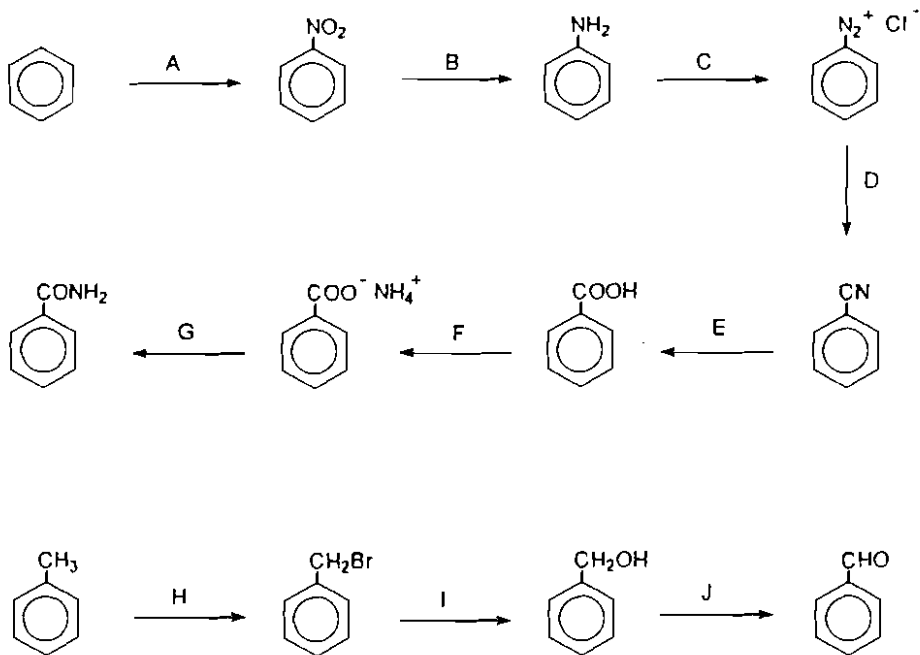
二、 **Reactions. (3 pts. each; 30 pts. total)**
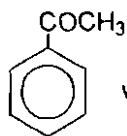
[COCH$_3$] with

A. I_2, NaOH $\longrightarrow$

B. NaCN, acid $\longrightarrow$

C. excess CH$_3$OH, acid $\longrightarrow$

D. NH$_2$NH$_2$, KOH, heat $\longrightarrow$

(methylcyclohexene) with

E. OsO$_4$ $\longrightarrow$

F. H$_2$SO$_4$ $\longrightarrow$

G. Br$_2$/H$_2$O $\longrightarrow$

H. HBr, peroxide $\longrightarrow$

I. KMnO$_4$, base, heat $\longrightarrow$

三、 Explain/Define the following terms:(2 pts each; 10 pts total)

(1) Beer's Law (2) Blind sample (3) Absorption (4) HETP

(5) Reversed-phase chromatography

四、 What is the purpose of a matrix modifier in atomic spectroscopy? (10 pts)

五、 The molar absorptivities of X and Y were measured with pure samples of each: (5 pts each; 10 pts total)

λ (nm)	ε (M^{-1} cm^{-1})	
	X	Y
λ^1=406	εx^1=720	εy^1=212
λ^2=457	εx^2=479	εy^2=274

A mixture of X and Y in a 1.0 cm cell had an absorbance of A^1=0.722 at 406 nm and A^2=0.641 at 457 nm. Find the concentrations of X and Y in the mixture.

六、 How do you confirm the accuracy of the analysis method? (10 pts)

七、 Briefly compare the LLE, SPE and SPME for the extraction liquid sample. (10