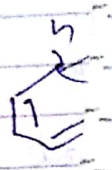


Br-
 $-\text{OH}, -\text{NR}_2, \text{O}^-, -\text{NH}_2 > -\text{OR} > \text{COR} > \text{NHCOCH}_3 > \text{CONH}_2 > \text{H}$

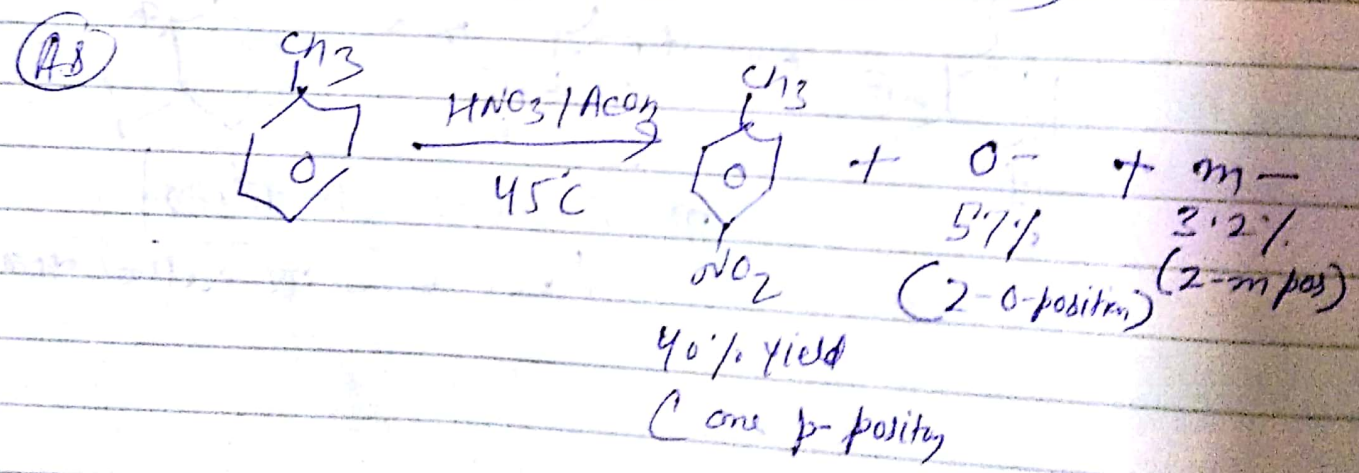
Quantitative treatment



→ aromatic substitution $\vec{r}$ orientation & reactivity
 $\vec{r}$ quantitative expression $\vec{r}$ $\vec{r}$ partial rate factor $\vec{r}$ convenient method $\vec{r}$ $\vec{r}$ partial rate factor $\vec{r}$ $\vec{r}$ show $\vec{r}$ $\vec{r}$

$$f = \frac{\text{Rate of reaction of substituted benzene}}{\text{Rate of reaction of benzene}} = \frac{\% \text{ of isomers of substituted benzene} \times \text{Rate of reaction of substituted benzene}}{100 \times \text{Rate of reaction of benzene}}$$

(f) → rate of substitution at the given position in substituted benzene relative to that of any one position in benzene (f is definition)



Relative reactivity of toluene to benzene = 24.5

$\rightarrow$ one p- (Sp) 1 site is
 $\rightarrow$ Benzene (6 carbon atoms)

$$p\text{-Me} = \frac{6}{1} \times \left(\frac{40}{100} \right) \times 24.5 = 59$$

Partial rate factor for the reactivity of p-position of toluene.

$$o\text{-Me} = \frac{6}{2} \times \left(\frac{57}{100} \right) \times 24.5 = 41.2$$

(2-o)

$$m\text{-Me} = \frac{6}{2} \times \left(\frac{3.2}{100} \right) \times 24.5 = 2.4$$

(2-m)

The relative reactivity of toluene to benzene (2)

$\rightarrow$ The reactivity of the p-position of toluene to benzene may be indicated as $\left(\frac{40}{100} \times 24.5 \right)$