

## Furans – Electrophilic Substitution

### Friedel-Crafts Acylation of Furan



- Blocking groups at the  $\alpha$  positions and high temperatures required to give  $\beta$  acylation

### Vilsmeier Formylation of Furan



### Mannich Reaction of Furans



## Thiophenes – Electrophilic Substitution

### Nitration of Thiophenes



- Reagent  $\text{AcONO}_2$  generated in situ from  $\text{o-HNO}_3$  and  $\text{Ac}_2\text{O}$

### Halogenation of Thiophenes



- Occurs readily at room temperature and even at  $-30^\circ\text{C}$
- Careful control of reaction conditions is required to ensure mono-bromination

75

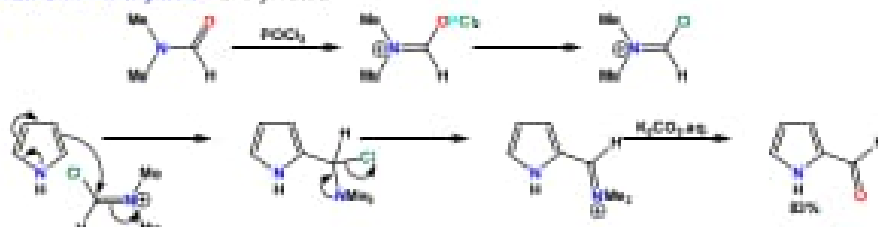
## Pyrroles – Electrophilic Substitution

### Nitration of Pyrroles



- Mild conditions are required ( $\text{o-HNO}_3$  and  $\text{c-H}_2\text{SO}_4$  gives decomposition)

### Vilsmeier Formylation of Pyrroles



76