Complete Named Reactions Checklist for JEE Main & Advanced

Nucleophilic Substitution Reactions

- ☐ **Finkelstein Reaction** R-Cl + NaI → R-I + NaCl *Mechanism: SN2 displacement*
- ☐ **Swarts Reaction** R-Cl + AgF → R-F + AgCl *Mechanism: SN2 nucleophilic substitution*

Elimination & Addition

- ☐ **Saytzeff's Rule** R-X + KOH → More substituted alkene *Mechanism: E2 elimination*
- ☐ **Hofmann Rule** $R_4N^+OH^-$ → Less substituted alkene *Mechanism: E2 elimination*
- ☐ **Markovnikov's Rule** R-CH=CH_2 + HBr → R-CHBr-CH_3 *Mechanism: Electrophilic addition*
- ☐ **Anti-Markovnikov's Rule** R-CH=CH_2 + HBr/ROOR → R-CH_2-CH_2Br *Mechanism: Free radical addition*

Coupling Reactions

- ☐ **Wurtz Reaction** 2R-X + 2Na → R-R + 2NaX *Mechanism: Free radical coupling*
- ☐ **Wurtz-Fittig Reaction** R-X + Ar-X + 2Na → R-Ar + 2NaX *Mechanism: Free radical coupling*
- ☐ **Fittig Reaction** 2Ar-X + 2Na → Ar-Ar + 2NaX *Mechanism: Free radical coupling*

Alcohols & Ethers

- ☐ **Williamson Synthesis** R-X + $R'O^-Na^+$ → R-O-R' + NaX *Mechanism: SN2 substitution*
- ☐ **Lucas Test** R-OH + $ZnCl_2$/HCl → R-Cl + H_2O *Mechanism: SN1/SN2 depending on alcohol*

Aldehydes & Ketones

- ☐ **Aldol Condensation** 2RCHO → RCH(OH)CH_2CHO → RCH=CHCHO *Mechanism: Nucleophilic addition-elimination*
- ☐ **Cross Aldol Condensation** RCHO + R'CHO → RCH=CHCOR' *Mechanism: Nucleophilic addition-elimination*
- ☐ **Cannizzaro Reaction** 2RCHO + OH^- → RCH_2OH + $RCOO^-$ *Mechanism: Hydride transfer*

- [ ] **Crossed Cannizzaro** $RCHO + R'CHO + OH^- \rightarrow RCH_2OH + R'COO^-$ *Mechanism: Hydride transfer*
- [ ] **Clemmensen Reduction** $RCOR' + Zn(Hg)/HCl \rightarrow RCH_2R'$ *Mechanism: Reduction via organometallic intermediate*
- [ ] **Wolff-Kishner Reduction** $RCOR' + NH_2NH_2/KOH \rightarrow RCH_2R'$ *Mechanism: Hydrazone formation followed by decomposition*
- [ ] **MPV Reduction** $RCOR' + Al(OiPr)_3 \rightarrow RCH(OH)R'$ *Mechanism: Hydride transfer*

Carboxylic Acids

- [ ] **Hell-Volhard-Zelinsky** $RCOOH + X_2/P \rightarrow RCHXCOOH$ *Mechanism: α-halogenation via acid halide*
- [ ] **Kolbe Electrolysis** $2RCOO^- \rightarrow R\text{-}R + 2CO_2 + 2e^-$ *Mechanism: Decarboxylation followed by radical coupling*

Aromatic Substitution

- [ ] **Friedel-Crafts Alkylation** $ArH + RX + AlCl_3 \rightarrow ArR + HX$ *Mechanism: Electrophilic aromatic substitution*
- [ ] **Friedel-Crafts Acylation** $ArH + RCOCl + AlCl_3 \rightarrow ArCOR + HCl$ *Mechanism: Electrophilic aromatic substitution*
- [ ] **Reimer-Tiemann** $ArOH + CHCl_3 + NaOH \rightarrow Ar\text{-}CHO$ *Mechanism: Carbene addition*
- [ ] **Kolbe-Schmidt** $ArONa + CO_2 \rightarrow ArOH\text{-}COOH$ *Mechanism: Electrophilic substitution*

Diazonium Reactions

- [ ] **Sandmeyer Reaction** $ArN_2^+X^- + CuX \rightarrow ArX + N_2$ *Mechanism: Single electron transfer*
- [ ] **Gattermann Reaction** $ArN_2^+Cl^- + Cu/HCl \rightarrow ArCl + N_2$ *Mechanism: Single electron transfer*

Amine Reactions

- [ ] **Hoffmann Bromamide** $RCONH_2 + Br_2/NaOH \rightarrow RNH_2 + CO_2$ *Mechanism: Rearrangement*
- [ ] **Gabriel Phthalimide** $C_8H_4O_2NK + RX \rightarrow RNH_2$ *Mechanism: SN2 followed by hydrazinolysis*

Rearrangements

- [ ] **Carbylamine Reaction** $RNH_2 + CHCl_3 + KOH \rightarrow RNC$ *Mechanism: α-elimination*
- [ ] **Pinacol-Pinacolone** $R_2C(OH)\text{-}C(OH)R_2 + H^+ \rightarrow R_3CCOR$ *Mechanism: 1,2-rearrangement*

- [ ] **Beckmann Rearrangement** $R_2C=NOH + H^+ \rightarrow RCONHR$ *Mechanism: Migration with N departure*
- [ ] **Hofmann Rearrangement** $RCONH_2 + Br_2/NaOH \rightarrow RNH_2$ *Mechanism: Migration to electron-deficient nitrogen*

Important Tests

- [ ] **Hinsberg Test** $RNH_2 + C_6H_5SO_2Cl \rightarrow$ Different products for 1°, 2°, 3° amines *Mechanism: Nucleophilic substitution*
- [ ] **Iodoform Test** $CH_3COR + I_2/NaOH \rightarrow CHI_3 + RCOONa$ *Mechanism: Base-catalyzed halogenation*

Polymer Formation

- [ ] **Free Radical Polymerization** $nCH_2=CHX \rightarrow -(CH_2-CHX)n-$ *Mechanism: Initiation, propagation, termination*
- [ ] **Condensation Polymerization** nA-A + nB-B → -(A-B)n- *Mechanism: Step-growth*

Rearrangement Reactions

- [ ] **Benzidine Rearrangement** $C_6H_5-N=N-C_6H_5 \rightarrow H_2N-C_6H_4-C_6H_4-NH_2$ *Mechanism: [1,2]-sigmatropic rearrangement*
- [ ] **Wagner-Meerwein Rearrangement** $R_3C^+ \rightarrow$ Migration of H or R *Mechanism: Carbocation rearrangement*
- [ ] **Claisen Rearrangement** Allyl phenyl ether → o-allylphenol *Mechanism: [3,3]-sigmatropic rearrangement*

Addition Reactions

- [ ] **Birch Reduction** $ArH + Na/NH_3 \rightarrow$ 1,4-dihydroArH *Mechanism: Radical anion formation*
- [ ] **Diels-Alder Reaction** Diene + dienophile → cyclohexene derivative *Mechanism: [4+2] cycloaddition*

Oxidation Reactions

- [ ] **Etard Reaction** $ArCH_3 + CrO_2Cl_2 \rightarrow ArCHO$ *Mechanism: Oxidation of toluene derivatives*
- [ ] **Oppenauer Oxidation** Secondary alcohol + $Al(OiPr)_3 \rightarrow$ Ketone *Mechanism: Hydride transfer (reverse of MPV)*

Substitution Reactions

- [ ] **Von Richter Reaction** $ArNO_2 + CN^- \rightarrow$ m-carboxylic acid *Mechanism: Nucleophilic aromatic substitution*
- [ ] **Bucherer Reaction** $ArOH \rightleftharpoons ArNH_2$ (interconversion) *Mechanism: Nucleophilic aromatic substitution*

Condensation Reactions

- [ ] **Perkin Reaction** $ArCHO + (RCO)_2O \rightarrow ArCH=CHCOOH$ *Mechanism: Aldol type condensation*
- [ ] **Knoevenagel Condensation** $RCHO + CH_2(COOR')_2 \rightarrow RCH=C(COOR')_2$ *Mechanism: Base-catalyzed condensation*

Elimination Reactions

- [ ] **Cope Elimination** $R_3N^+O^- \rightarrow$ Alkene + R_2NOH *Mechanism: syn-elimination*

Important Name Reactions with Reagents

- [ ] **Reformatsky Reaction** $RCHO + BrCH_2COOR' + Zn \rightarrow$ β-hydroxy ester *Mechanism: Organozinc addition*
- [ ] **Stephen Reaction** $RCN + SnCl_2/HCl \rightarrow RCHO$ *Mechanism: Reduction of nitrile*

Additional Test Reactions

- [ ] **Beilstein Test** For halogens (green flame) *Mechanism: CuX formation*
- [ ] **Tollens' Test** $RCHO + [Ag(NH_3)_2]^+ \rightarrow RCOO^- + Ag\downarrow$ *Mechanism: Oxidation of aldehyde*

Special Mention

- [ ] **Fischer Esterification** $RCOOH + R'OH \rightleftharpoons RCOOR' + H_2O$ *Mechanism: Nucleophilic acyl substitution*
- [ ] **Grignard Reaction** RMgX + various substrates *Mechanism: Nucleophilic addition*