EMBRACE
COACHING ACADEMY

CLASS 12 · CHEMISTRY

ORGANIC CHEMISTRY

Reaction *Problems*

Complete Study Guide

◆

RX
NAMED REACTIONS

A → B
REACTION CHAINS

→ C
PRODUCT IDENTIFICATION

★
EXPLANATIONS INCLUDED

NH_2
AMINES & DIAZONIUM

OH
PHENOLS & ALCOHOLS

CHO
ALDEHYDES & KETONES

COOH
CARBOXYLIC ACIDS

70	28	2	100%
QUESTIONS	NAMED REACTIONS	QUESTION SETS	EXAM READY

STEP-BY-STEP REACTIONS
Every reaction written with reagents, conditions and products

WHY IT WORKS
Explanations for each mechanism — not just the answer

IUPAC & COMMON NAMES
Every compound labelled with formula and both names

QUICK REFERENCE TABLE
Master named reactions chart at the end for fast revision

$C_6H_5Cl \xrightarrow{NaOH} C_6H_5OH \xrightarrow{CO_2/\Delta}$ Salicylic Acid · $C_6H_5NH_2 \xrightarrow{NaNO_2/HCl} C_6H_5N_2Cl \xrightarrow{Coupling}$ Azo Dye

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CLASS 12 · CHEMISTRY

EMBRACE COACHING ACADEMY

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CLASS 12 — CHEMISTRY

ORGANIC CHEMISTRY

Complete Reaction Problems — With Reactions, Explanations & Named Reactions

Compiled by

Embrace Coaching Academy

70 Questions | Complete Reactions | Explanations | Answer Tables | Named Reactions

HOW TO USE THESE NOTES

Each question is presented in 4 parts:

1. Question — the original problem statement
2. Named Reaction — the key reaction concept involved
3. Step-by-step Reactions — the actual chemistry
4. Answer Table — labelled compounds with formulas and names

> *Explanation: Orange boxes contain key explanations. Always read them — they explain WHY the reaction works, not just WHAT the product is. Named reactions are in purple. Answers are in green tables.*

SECTION 1 — SET A: 20 QUESTIONS

Q1. *C6H6O (A) — Phenol with NH3 and Zn*

Named Reaction: Reduction & Ammonolysis of Phenol

Reactions:

Step	Reaction
A→B	C6H5OH + NH3 → C6H5NH2 (Aniline)
A→C	C6H5OH + Zn → C6H6 + ZnO (Benzene)

Explanation: Phenol (C6H5OH) reacts with ammonia (NH3) under catalyst to give Aniline (primary amine). With zinc, the -OH group is removed and benzene is produced (reduction of phenol).

Answer Summary:

Label	Formula	Name
A	C6H5OH	**Phenol**
B	C6H5NH2	**Aniline**
C	C6H6	**Benzene**

Q2. *C7H6O (A) — Benzaldehyde via Cannizzaro reaction*

Named Reaction: Cannizzaro Reaction + Decarboxylation (Sodalime)

Reactions:

Step	Reaction
A	C7H6O = C6H5CHO (Benzaldehyde)
A→B,C	2C6H5CHO + 50%NaOH → C6H5CH2OH (B) + C6H5COONa (C) [Cannizzaro]
C→D	C6H5COONa + HCl → C6H5COOH (D) + NaCl
D→E	C6H5COOH + NaOH + CaO/heat → C6H6 (E) + CaCO3 [Sodalime]

> *Explanation: Benzaldehyde (no alpha-H) undergoes disproportionation with NaOH (Cannizzaro). One molecule is oxidised to sodium benzoate (C), the other is reduced to benzyl alcohol (B). Acid gives benzoic acid (D); dry distillation with sodalime gives benzene (E).*

Answer Summary:

Label	Formula	Name
A	`C6H5CHO`	**Benzaldehyde**
B	`C6H5CH2OH`	**Benzyl Alcohol**
C	`C6H5COONa`	**Sodium Benzoate**
D	`C6H5COOH`	**Benzoic Acid**
E	`C6H6`	**Benzene**

Q3. *C2H6O (A) — Ethanol dehydration, hydroxylation, etherification*

Named Reaction: Dehydration + Baeyer's Hydroxylation + Etherification

Reactions:

Step	Reaction
A→B	`C2H5OH + conc.H2SO4/443K → CH2=CH2 (Dehydration)`
B→C	`CH2=CH2 + Baeyer's reagent (alk.KMnO4) → HOCH2CH2OH (Ethane-1,2-diol)`
C→D	`HOCH2CH2OH + anhydrous ZnCl2 → CH3CHO (Ethanal)`
A→E	`C2H5OH + conc.H2SO4/413K → C2H5OC2H5 (Ethoxyethane)`

> *Explanation: At 443K, ethanol loses water to form ethylene. Baeyer's reagent (cold alkaline KMnO4) hydroxylates the double bond to ethane-1,2-diol. At 413K, intermolecular dehydration gives diethyl ether. Temperature controls which product forms.*

Answer Summary:

Label	Formula	Name
A	`C2H5OH`	**Ethanol**
B	`CH2=CH2`	**Ethylene (Ethene)**
C	`HOCH2CH2OH`	**Ethane-1,2-diol (Glycol)**

D	CH3CHO	**Ethanal**
E	C2H5OC2H5	**Ethoxyethane (Diethyl Ether)**

Q4. *CH4O (A) — Methanol to Ethanol via Grignard*

Named Reaction: Grignard Reaction (Chain Extension by 1 Carbon)

Reactions:

Step	Reaction
A→B	CH3OH + Tollens' reagent → HCHO (Methanal)
B→C	HCHO + CH3MgBr → [CH3CH2OMgBr] + H2O/H+ → CH3CH2OH (Ethanol)

Explanation: Methanol oxidised by Tollens' reagent gives methanal (formaldehyde). Methanal reacts with CH3MgBr (Grignard reagent) — the carbanion adds to the carbonyl. Hydrolysis gives ethanol. This is a classic one-carbon chain extension.

Answer Summary:

Label	Formula	Name
A	CH3OH	**Methanol**
B	HCHO	**Methanal (Formaldehyde)**
C	CH3CH2OH	**Ethanol**

Q5. *C2H6O (A) — Ethanol to Propanone via Grignard*

Named Reaction: Grignard Reaction + Oxidative Dehydrogenation (Cu/573K)

Reactions:

Step	Reaction
A→B	C2H5OH + Cu/573K → CH3CHO (Ethanal) [Dehydrogenation]
B→C	CH3CHO + CH3MgBr + H2O/H+ → (CH3)2CHOH (Propan-2-ol)

C→D	(CH3)2CHOH + Cu/573K → (CH3)2CO (Propanone)

> *Explanation: Ethanol dehydrogenates at Cu/573K to ethanal. The Grignard reagent CH3MgBr adds to ethanal; hydrolysis gives propan-2-ol (secondary alcohol). Cu/573K again oxidises the secondary alcohol to propanone (a ketone).*

Answer Summary:

Label	Formula	Name
A	C2H5OH	**Ethanol**
B	CH3CHO	**Ethanal**
C	(CH3)2CHOH	**Propan-2-ol**
D	(CH3)2CO	**Propanone (Acetone)**

Q6. *C6H5Cl (A) — Chlorobenzene to Aniline via Dow's Process*

Named Reaction: Dow's Process + Ammonolysis of Phenol

Reactions:

Step	Reaction
A→B	C6H5Cl + NaOH (high T, P) → C6H5OH (Phenol) [Dow's Process]
B→C	C6H5OH + NH3 + anhydrous ZnCl2/heat → C6H5NH2 (Aniline)

> *Explanation: Chlorobenzene heated with NaOH under high temperature and pressure (Dow's process) hydrolyses to phenol. Phenol then reacts with ammonia in presence of anhydrous ZnCl2 to form aniline.*

Answer Summary:

Label	Formula	Name
A	C6H5Cl	**Chlorobenzene**
B	C6H5OH	**Phenol**
C	C6H5NH2	**Aniline**

Q7. *C6H5Cl (A) — Chlorobenzene to Salicylic Acid (Kolbe's Reaction)*

Named Reaction: Dow's Process + Kolbe's Reaction

Reactions:

Step	Reaction
A→B	C6H5Cl + NaOH → C6H5OH (Phenol) [Dow's Process]
B→C	C6H5OH + NaOH → C6H5ONa (Sodium Phenoxide)
C→D	C6H5ONa + CO2 / 400K / 4-7 bar → Sodium Salicylate → H+/H2O → C6H4(OH)COOH [Kolbe's Reaction]

> *Explanation: Phenol forms sodium phenoxide with NaOH. Treating with CO2 under pressure at 400K introduces a carboxyl group at the ortho position (Kolbe's reaction). Acidification gives salicylic acid — the parent compound of Aspirin.*

Answer Summary:

Label	Formula	Name
A	C6H5Cl	**Chlorobenzene**
B	C6H5OH	**Phenol**
C	C6H5ONa	**Sodium Phenoxide**
D	C6H4(OH)COOH	**Salicylic Acid (2-Hydroxybenzoic acid)**

Q8. *C6H5N2Cl (A) — Diazonium salt to Toluene*

Named Reaction: Hydrolysis + Friedel-Crafts Alkylation

Reactions:

Step	Reaction
A→B	C6H5N2Cl + H2O → C6H5OH (Phenol) + N2 + HCl
B→C	C6H5OH + Zn → C6H6 (Benzene)
C→D	C6H6 + CH3Cl + anhydrous AlCl3 → C6H5CH3 (Toluene) [Friedel-Crafts]

> *Explanation: Diazonium chloride hydrolyses to phenol. Zinc reduces phenol to benzene (simplest aromatic hydrocarbon). Benzene undergoes Friedel-Crafts alkylation with CH3Cl/AlCl3 to give toluene (methylbenzene).*

Answer Summary:

Label	Formula	Name
A	`C6H5N2Cl`	**Benzene Diazonium Chloride**
B	`C6H5OH`	**Phenol**
C	`C6H6`	**Benzene**
D	`C6H5CH3`	**Toluene (Methylbenzene)**

Q9. *C6H6 (A) — Benzene to Phenol via Cumene Process*

Named Reaction: Cumene Process (Industrial Phenol Synthesis)

Reactions:

Step	Reaction
A→B	`C6H6 + CH3CH=CH2 + H3PO4/523K → C6H5CH(CH3)2 (Cumene)`
B→C	`C6H5CH(CH3)2 + Air/O2 → C6H5C(CH3)2OOH (Cumene Hydroperoxide)`
C→D	`C6H5C(CH3)2OOH + H2SO4 → C6H5OH (Phenol) + CH3COCH3 (Acetone)`

> *Explanation: Benzene alkylated with propylene (Friedel-Crafts, H3PO4 catalyst) gives cumene. Air oxidation gives cumene hydroperoxide. Acid cleavage simultaneously gives phenol and acetone — an important industrial synthesis.*

Answer Summary:

Label	Formula	Name
A	`C6H6`	**Benzene**
B	`C6H5CH(CH3)2`	**Cumene (Isopropylbenzene)**
C	`C6H5C(CH3)2OOH`	**Cumene Hydroperoxide**
D	`C6H5OH`	**Phenol**

Q10. *C3H8O (A) — Propan-2-ol to Nitroso compound*

Named Reaction: Halogenation, Nitration & Nitrosation

Reactions:

Step	Reaction
A→B	CH3CH(OH)CH3 + P/I2 → CH3CHICH3 (2-Iodopropane)
B→C	CH3CHICH3 + AgNO2 → CH3CH(NO2)CH3 (2-Nitropropane)
C→D	CH3CH(NO2)CH3 + HNO2 → CH3C(NO2)(NO)CH3 [Blue colour — 2-Nitro-2-nitrosopropane]

Explanation: Propan-2-ol reacts with P/I2 to give 2-iodopropane. AgNO2 (silver nitrite) displaces iodide via SN2 to give 2-nitropropane. Treatment with nitrous acid adds a nitroso group, giving a blue-coloured compound.

Answer Summary:

Label	Formula	Name
A	CH3CH(OH)CH3	**Propan-2-ol**
B	CH3CHICH3	**2-Iodopropane**
C	CH3CH(NO2)CH3	**2-Nitropropane**
D	CH3C(NO2)(NO)CH3	**2-Nitro-2-nitrosopropane (Blue colour)**

Q11. *C2H6O (A) — Ethanol to Ethane-1,2-diol*

Named Reaction: Dehydration + Baeyer's Hydroxylation

Reactions:

Step	Reaction
A→B	CH3CH2OH + Al2O3/620K → CH2=CH2 (Ethene)
B→C	CH2=CH2 + Baeyer's reagent → CH2(OH)CH2(OH) (Ethane-1,2-diol)

Explanation: Ethanol dehydrates over alumina at 620K to give ethylene. Baeyer's reagent (cold alkaline KMnO4 or OsO4) oxidises the double bond (syn addition) to give ethane-1,2-diol (ethylene glycol — used as antifreeze).

Answer Summary:

Label	Formula	Name
A	CH3CH2OH	**Ethanol**
B	CH2=CH2	**Ethene (Ethylene)**
C	HOCH2CH2OH	**Ethane-1,2-diol (Ethylene glycol)**

Q12. *C6H6O (A) — Phenol via Reimer-Tiemann Reaction*

Named Reaction: Reimer-Tiemann Reaction + Ammonolysis

Reactions:

Step	Reaction
A→B	C6H5OH + CHCl3/NaOH → 2-HO-C6H4-CHO (Salicylaldehyde) [Reimer-Tiemann]
A→C	C6H5OH + NH3/anhydrous ZnCl2/heat → C6H5NH2 (Aniline)

Explanation: Phenol treated with chloroform and NaOH — the intermediate :CCl2 (dichlorocarbene) electrophile attacks the ring at ortho position. After hydrolysis, salicylaldehyde forms (Reimer-Tiemann). Separately, phenol with NH3/ZnCl2 gives aniline.

Answer Summary:

Label	Formula	Name
A	C6H5OH	**Phenol**
B	2-HO-C6H4-CHO	**Salicylaldehyde (2-Hydroxybenzaldehyde)**
C	C6H5NH2	**Aniline**

Q13. *C6H5NO2 (A) — Nitrobenzene to N-Methyl Aniline*

Named Reaction: Reduction + Carbylamine Reaction + Catalytic Reduction

Reactions:

Step	Reaction

A→B	C6H5NO2 + Sn/HCl → C6H5NH2 (Aniline)
B→C	C6H5NH2 + CHCl3/3KOH → C6H5NC (Phenyl Isocyanide) [Carbylamine test]
C→D	C6H5NC + Na/C2H5OH or Ni/H2 → C6H5NHCH3 (N-Methyl Aniline)

> *Explanation: Nitrobenzene reduces to aniline (Sn/HCl). Aniline undergoes carbylamine reaction (isocyanide reaction — foul smell, used to detect primary amines) giving phenyl isocyanide. Reduction of isocyanide gives N-methyl aniline (secondary amine).*

Answer Summary:

Label	Formula	Name
A	C6H5NO2	**Nitrobenzene**
B	C6H5NH2	**Aniline**
C	C6H5NC	**Phenyl Carbylamine (Isocyanide)**
D	C6H5NHCH3	**N-Methyl Aniline**

Q14. *C3H4 (A) — Prop-1-yne to multiple products*

Named Reaction: Hydration (Markovnikov) + Iodoform + Wolff-Kishner + Crossed Cannizzaro

Reactions:

Step	Reaction
A→B	CH3C≡CH + Hg2+/H2SO4/H2O → CH3COCH3 (Propanone) [Markovnikov's rule]
B→(test)	CH3COCH3 + 3I2/NaOH → CHI3 + CH3COONa [Positive Iodoform Test]
B→C	CH3COCH3 + N2H4/C2H5ONa → CH3CH2CH3 (Propane) [Wolff-Kishner reduction]
B→D	CH3COCH3 + HCHO + dil.NaOH → CH2(OH)CH2COCH3 [Crossed Cannizzaro]

> *Explanation: Prop-1-yne hydrated following Markovnikov's rule gives propanone (methyl ketone). Propanone gives positive iodoform test (yellow CHI3 precipitate). Wolff-Kishner (N2H4 + base) removes C=O to give propane. Crossed Cannizzaro with HCHO gives 4-hydroxybutan-2-one.*

Answer Summary:

Label	Formula	Name
A	`CH3C≡CH`	**Prop-1-yne**
B	`CH3COCH3`	**Propanone (Acetone)**
C	`CH3CH2CH3`	**Propane (via Wolff-Kishner)**
D	`CH2(OH)CH2COCH3`	**4-Hydroxybutan-2-one**

Q15. *C3H8O3 (A) — Glycerol via Fenton's Reagent*

Named Reaction: Fenton's Reagent Oxidation of Glycerol

Reactions:

Step	Reaction
A	`A = CH2OH-CHOH-CH2OH (Glycerol / Propan-1,2,3-triol)`
A→B,C	`Glycerol + FeSO4+H2O2 → CHO-CHOH-CH2OH (B) + CH2OH-CO-CH2OH (C)`
Note	`Mixture of B and C = Glycerose`

> *Explanation: Glycerol is a trihydric alcohol. Fenton's reagent (FeSO4 + H2O2) oxidises either the central or terminal -CH(OH)- to give glyceraldehyde (B = 2,3-dihydroxypropanal) or dihydroxyacetone (C = 1,3-dihydroxypropan-2-one). The mixture is called glycerose.*

Answer Summary:

Label	Formula	Name
A	`HOCH2CH(OH)CH2OH`	**Propan-1,2,3-triol (Glycerol)**
B	`CHO-CHOH-CH2OH`	**2,3-Dihydroxy Propanal (Glyceraldehyde)**
C	`CH2OH-CO-CH2OH`	**1,3-Dihydroxypropan-2-one (Dihydroxyacetone)**

Q16. *C7H7NO (A) — Benzamide to Azo Dye*

Named Reaction: Hoffmann Bromamide Reaction + Diazotisation + Azo Coupling

Reactions:

Step	Reaction
A→B	C6H5CONH2 + Br2/KOH → C6H5NH2 (Aniline) [Hoffmann Bromamide — 1 carbon less]
B→C	C6H5NH2 + NaNO2/HCl/273-278K → C6H5N2Cl (Benzene Diazonium Chloride) [Diazotisation]
C→D	C6H5N2Cl + p-cresol/pH 9-10 → 2-Phenylazo-4-methylphenol (Azo dye) [Coupling]

> *Explanation: Benzamide loses one carbon via Hoffmann bromamide rearrangement to give aniline (C7→C6). Aniline diazotises with NaNO2/HCl at 273-278K to give diazonium salt. Coupling with p-cresol at pH 9-10 gives an orange-red azo dye.*

Answer Summary:

Label	Formula	Name
A	C6H5CONH2	**Benzamide**
B	C6H5NH2	**Aniline**
C	C6H5N2Cl	**Benzene Diazonium Chloride**
D	CH3-C6H4-N=N-C6H5(OH)	**2-Phenylazo-4-methylphenol (Azo Dye)**

Q17. *C2H4O (A) — Methanal reactions*

Named Reaction: Acetal Formation + Tischenko Reaction

Reactions:

Step	Reaction
A	C2H4O = HCHO (Methanal / Formaldehyde)
A→B	HCHO + Methanol/HCl → C4H10O2 (Dimethoxymethane — Acetal)
A→C	HCHO + dil.NaOH → HCOOCH3 (Methyl Formate) [Tischenko Reaction]

> *Explanation: Methanal reacts with methanol in HCl to form an acetal (dimethoxymethane). With dilute NaOH (Tischenko reaction), methanal disproportionates to methyl formate — one HCHO is oxidised, the other reduced.*

Answer Summary:

Label	Formula	Name

A	`HCHO`	**Methanal (Formaldehyde)**
B	`CH3OCH2OCH3`	**Dimethoxymethane (Acetal)**
C	`HCOOCH3`	**Methyl Formate (Tischenko product)**

Q18. *C2H5Br (A) — Bromoethane to Propanoic Acid via Grignard*

Named Reaction: Grignard Reaction + Carboxylation (CO2)

Reactions:

Step	Reaction
A→B	`C2H5Br + Mg/dry ether → C2H5MgBr (Ethyl Magnesium Bromide)`
B→C	`C2H5MgBr + CO2/dry ether → C2H5COOMgBr + H2O/H+ → C2H5COOH`

> *Explanation: Bromoethane reacts with Mg in dry ether to form a Grignard reagent (strong nucleophile). Reaction with dry CO2 followed by hydrolysis gives propanoic acid — chain is extended by one carbon (C2 → C3 acid).*

Answer Summary:

Label	Formula	Name
A	`C2H5Br`	**Bromoethane**
B	`C2H5MgBr`	**Ethyl Magnesium Bromide (Grignard Reagent)**
C	`C2H5COOH`	**Propanoic Acid**

Q19. *(A) Nitrobenzene → N-Methyl Aniline, N-Phenyl Benzamide, Diazonium Salt*

Named Reaction: Reduction + Schotten-Baumann + Diazotisation

Reactions:

Step	Reaction
A→B	`C6H5NO2 + Sn/HCl → C6H5NH2 (Aniline)`
B→C	`C6H5NH2 + C6H5COCl/Pyridine → C6H5NHCOC6H5 (N-Phenyl Benzamide) [Schotten-Baumann]`

B→D	C6H5NH2 + CH3Br → C6H5NHCH3 (N-Methyl Aniline)
B→E	C6H5NH2 + NaNO2/HCl → C6H5N2Cl (Benzene Diazonium Chloride) [Diazotisation]

> *Explanation: Nitrobenzene reduces to aniline. Aniline reacts with benzoyl chloride in pyridine (Schotten-Baumann) to give N-phenyl benzamide. Methylation gives N-methyl aniline. Diazotisation at 273-278K gives diazonium salt.*

Answer Summary:

Label	Formula	Name
A	C6H5NO2	**Nitrobenzene**
B	C6H5NH2	**Aniline**
C	C6H5NHCOC6H5	**N-Phenyl Benzamide**
D	C6H5NHCH3	**N-Methyl Aniline**
E	C6H5N2Cl	**Benzene Diazonium Chloride**

Q20. *C2H6O (A) — Ethanol complete reaction chain*

Named Reaction: Temperature-Controlled Dehydration + Baeyer's + Etherification

Reactions:

Step	Reaction
A→B	C2H5OH + conc.H2SO4/443K → CH2=CH2 (Ethylene)
B→C	CH2=CH2 + Baeyer's reagent → HOCH2CH2OH (Ethane-1,2-diol)
A→E	C2H5OH + conc.H2SO4/413K → C2H5OC2H5 (Diethyl Ether)

> *Explanation: Same as Q3. Key point: Temperature determines product. At 443K → alkene (intramolecular dehydration). At 413K → ether (intermolecular dehydration). Baeyer's reagent converts alkene to glycol.*

Answer Summary:

Label	Formula	Name
A	C2H5OH	**Ethanol**
B	CH2=CH2	**Ethylene**

C	`HOCH2CH2OH`	**Ethane-1,2-diol**
E	`C2H5OC2H5`	**Ethoxyethane (Diethyl Ether)**

SECTION 2 — SET B: 50 QUESTIONS (SS Prithvi Set)

Q1. *CH_3-CHO + NH_2OH → A; A + P_2O_5 → B*

Named Reaction: Oxime Formation + Dehydration to Nitrile

Reactions:

Step	Reaction
A	`CH3-CHO + NH2OH → CH3-CH=N-OH (Acetaldoxime)`
B	`CH3-CH=N-OH + P2O5 → CH3-CN (Methylcyanide / Acetonitrile)`

> *Explanation: Acetaldehyde reacts with hydroxylamine (NH_2OH) via condensation to form acetaldoxime (an oxime). P_2O_5 is a dehydrating agent that removes water from the oxime to give methyl cyanide (nitrile).*

Answer Summary:

Label	Formula	Name
A	`CH3-CH=N-OH`	**Acetaldoxime**
B	`CH3-CN`	**Methylcyanide (Acetonitrile)**

Q2. *CH_3-CH=CH_2 with H_2O/H^+ and $B_2H_6/H_2O_2/OH^-$*

Named Reaction: Markovnikov Addition vs Anti-Markovnikov (Hydroboration-Oxidation)

Reactions:

Step	Reaction
A (acid-catalysed)	`CH3-CH=CH2 + H2O/H+ → CH3-CH(OH)-CH3 (Isopropyl alcohol)`
B (hydroboration)	`CH3-CH=CH2 + B2H6, then H2O2/OH- → CH3-CH2-CH2-OH (n-Propyl alcohol)`

> *Explanation: H_2O/H^+ follows Markovnikov's rule — H adds to less substituted carbon, OH to more substituted — giving isopropyl alcohol (2°). Hydroboration-oxidation (B_2H_6 then H_2O_2/OH^-) is anti-Markovnikov giving n-propyl alcohol (1°). This is a key comparison!*

Answer Summary:

Label	Formula	Name
A	CH3CH(OH)CH3	**Isopropyl Alcohol (Propan-2-ol) [Markovnikov]**
B	CH3CH2CH2OH	**n-Propyl Alcohol (Propan-1-ol) [Anti-Markovnikov]**

Q3. *C6H5-OH with Zn and with NaOH + C6H5COCl*

Named Reaction: Reduction of Phenol + Ester Formation (Schotten-Baumann)

Reactions:

Step	Reaction
A	C6H5-OH + Zn → C6H6 + ZnO (Benzene)
B	C6H5-OH + C6H5-COCl + NaOH → C6H5-CO-O-C6H5 + NaCl + H2O (Phenyl Benzoate)

Explanation: Zinc reduces phenol to benzene by removing the -OH group. With benzoyl chloride and NaOH, phenol forms phenyl benzoate — an ester. This is the Schotten-Baumann condition for ester formation from phenol.

Answer Summary:

Label	Formula	Name
A	C6H6	**Benzene**
B	C6H5COOC6H5	**Phenyl Benzoate (Ester)**

Q4. *C2H6O (A) → C2H4O2 (B) → C4H6O4Ca (C) → C3H6O (D)*

Named Reaction: Oxidation + Calcium Salt Formation + Dry Distillation (Ketone synthesis)

Reactions:

Step	Reaction
A	CH3CHO (Acetaldehyde)
A→B	CH3CHO + K2Cr2O7 → CH3COOH (Acetic acid)

B→C	2CH3COOH + Ca(OH)2 → (CH3COO)2Ca (Calcium acetate)
C→D	(CH3COO)2Ca + heat/distillation → CH3COCH3 + CaCO3 (Acetone)

> *Explanation: Acetaldehyde oxidised by K2Cr2O7 gives acetic acid. Neutralisation with Ca(OH)2 gives calcium acetate. Dry distillation of calcium acetate gives acetone (ketone) — a classical method of ketone synthesis from carboxylic acid calcium salts.*

Answer Summary:

Label	Formula	Name
A	CH3CHO	**Acetaldehyde**
B	CH3COOH	**Acetic Acid**
C	(CH3COO)2Ca	**Calcium Acetate**
D	CH3COCH3	**Acetone**

Q5. *C6H5-NO2 with three different reagents*

Named Reaction: Selective Reduction of Nitrobenzene

Reactions:

Step	Reaction
A	C6H5-NO2 + Sn/HCl → C6H5-NH2 (Aniline) [Complete reduction]
B	C6H5-NO2 + Zn/NH4Cl → C6H5-NH-OH (Phenyl hydroxylamine) [Partial reduction]
C	C6H5-NO2 + Zn/NaOH → C6H5-NH-NH-C6H5 (Hydrazobenzene) [Alkaline reduction]

> *Explanation: Nitrobenzene can be selectively reduced based on the reagent. Sn/HCl gives complete reduction to aniline. Zn/NH4Cl gives partial reduction to phenyl hydroxylamine. Zn/NaOH in alkaline medium gives hydrazobenzene (bimolecular product). These are called controlled reductions.*

Answer Summary:

Label	Formula	Name
A	C6H5-NH2	**Aniline (Sn/HCl)**
B	C6H5-NH-OH	**Phenyl Hydroxylamine (Zn/NH4Cl)**

C	C6H5-NH-NH-C6H5	**Hydrazobenzene (Zn/NaOH)**

Q6. *Benzene to o-Cyano toluene via 5-step synthesis*

Named Reaction: Friedel-Crafts → Nitration → Reduction → Diazotisation → Sandmeyer

Reactions:

Step	Reaction
A	C6H6 + CH3Cl/AlCl3 → C6H5CH3 (Toluene) [Friedel-Crafts Alkylation]
B	C6H5CH3 + conc.HNO3/H2SO4 → o-CH3-C6H4-NO2 (o-Nitrotoluene)
C	o-CH3-C6H4-NO2 + Sn/HCl → o-CH3-C6H4-NH2 (o-Aminotoluene)
D	o-CH3-C6H4-NH2 + NaNO2/HCl → o-CH3-C6H4-N2Cl (o-Methyl benzene diazonium chloride)
E	o-CH3-C6H4-N2Cl + CuCN → o-CH3-C6H4-CN (o-Cyano toluene) [Sandmeyer]

> *Explanation: Benzene is alkylated to toluene. Electrophilic nitration gives o-nitrotoluene (ortho director). Sn/HCl reduces to o-aminotoluene. Diazotisation converts -NH2 to diazonium salt. Sandmeyer reaction with CuCN replaces -N2+ with -CN giving o-cyano toluene.*

Answer Summary:

Label	Formula	Name
A	C6H5CH3	**Toluene**
B	o-CH3-C6H4-NO2	**o-Nitrotoluene**
C	o-CH3-C6H4-NH2	**o-Aminotoluene**
D	o-CH3-C6H4-N2Cl	**o-Methylbenzene Diazonium Chloride**
E	o-CH3-C6H4-CN	**o-Cyano Toluene**

Q7. *C6H5-CHO with Zn-Hg/HCl, OH-/KMnO4 and NaOH/CaO*

Named Reaction: Clemmensen Reduction + Oxidation + Decarboxylation

Reactions:

Step	Reaction
A	C6H5-CHO + Zn-Hg/HCl → C6H5-CH3 (Toluene) [Clemmensen Reduction]
B	C6H5-CH3 + OH-/KMnO4 → C6H5-COOH (Benzoic acid) [Oxidation]
C	C6H5-COOH + NaOH/CaO/heat → C6H6 (Benzene) [Decarboxylation / Sodalime]

> *Explanation: Benzaldehyde is reduced by Clemmensen (Zn-Hg/HCl) to toluene (converts C=O to CH2). KMnO4/OH- oxidises the methyl group to carboxyl giving benzoic acid. Heating with NaOH/CaO (sodalime) removes the COOH group to give benzene.*

Answer Summary:

Label	Formula	Name
A	C6H5CH3	**Toluene**
B	C6H5COOH	**Benzoic Acid**
C	C6H6	**Benzene**

Q8. *Ethanoic acid → A (SOCl2) → B (Pd/BaSO4) → C (NaOH)*

Named Reaction: Rosenmund Reduction + Aldol Condensation

Reactions:

Step	Reaction
A	CH3COOH + SOCl2 → CH3COCl (Acetyl chloride)
B	CH3COCl + Pd/BaSO4 → CH3CHO (Acetaldehyde) [Rosenmund Reduction]
C	2CH3CHO + dil.NaOH → CH3CH(OH)CH2CHO (Aldol = 3-Hydroxybutanal) [Aldol Condensation]

> *Explanation: Acetic acid reacts with SOCl2 to form acetyl chloride (acid chloride). Pd/BaSO4 (Rosenmund catalyst) selectively reduces acid chloride to aldehyde (acetaldehyde). Two molecules of acetaldehyde undergo aldol condensation with dilute NaOH to form aldol.*

Answer Summary:

Label	Formula	Name
A	CH3COCl	**Acetyl Chloride**
B	CH3CHO	**Acetaldehyde**
C	CH3CH(OH)CH2CHO	**Aldol (3-Hydroxybutanal)**

Q9. *C6H5-NO2 → A (Sn/HCl) → B (Br2/H2O)*

Named Reaction: Reduction + Electrophilic Bromination of Aniline

Reactions:

Step	Reaction
A	C6H5-NO2 + Sn/HCl → C6H5-NH2 (Aniline)
B	C6H5-NH2 + Br2/H2O → 2,4,6-Tribromoaniline (white precipitate)

Explanation: Nitrobenzene reduces to aniline. The -NH2 group is a powerful ortho/para director. With Br2/H2O (no catalyst needed), all three available positions (2,4,6) are brominated immediately to give 2,4,6-tribromoaniline (white precipitate — used as a test for aniline).

Answer Summary:

Label	Formula	Name
A	C6H5NH2	**Aniline**
B	2,4,6-Br3-C6H2-NH2	**2,4,6-Tribromoaniline**

Q10. *C6H5N2Cl → A (CuCN) → B (H2O/H+)*

Named Reaction: Sandmeyer Reaction + Hydrolysis of Nitrile

Reactions:

Step	Reaction
A	C6H5N2Cl + CuCN → C6H5-CN (Phenyl cyanide / Benzonitrile) [Sandmeyer]

B	`C6H5-CN + H2O/H+ → C6H5-COOH (Benzoic acid)  [Hydrolysis]`

> *Explanation: Sandmeyer reaction replaces -N2+ with -CN using cuprous cyanide (CuCN), giving benzonitrile. Acid hydrolysis of the nitrile converts -CN to -COOH, giving benzoic acid. This is a useful 2-step route from amine to carboxylic acid.*

Answer Summary:

Label	Formula	Name
A	`C6H5-CN`	**Phenyl Cyanide (Benzonitrile)**
B	`C6H5-COOH`	**Benzoic Acid**

Q11. *C6H5-COOH → A (PCl5) → B (C6H6/AlCl3)*

Named Reaction: Acid Chloride Formation + Friedel-Crafts Acylation

Reactions:

Step	Reaction
A	`C6H5-COOH + PCl5 → C6H5-COCl (Benzoyl chloride)`
B	`C6H5-COCl + C6H6/anhydrous AlCl3 → C6H5-CO-C6H5 (Benzophenone) [Friedel-Crafts Acylation]`

> *Explanation: Benzoic acid reacts with PCl5 (or SOCl2) to convert -COOH to -COCl (acid chloride). Benzoyl chloride undergoes Friedel-Crafts acylation with benzene and anhydrous AlCl3 to give benzophenone (diphenyl ketone).*

Answer Summary:

Label	Formula	Name
A	`C6H5COCl`	**Benzoyl Chloride**
B	`C6H5COC6H5`	**Benzophenone (Diphenyl Ketone)**

Q12. *C6H5-CONH2 → A (Br2/NaOH) → B (NaNO2/HCl)*

Named Reaction: Hoffmann Bromamide Reaction + Diazotisation

Reactions:

Step	Reaction
A	`C6H5-CONH2 + Br2/NaOH → C6H5-NH2 (Aniline) [Hoffmann — 1 C less]`
B	`C6H5-NH2 + NaNO2/HCl/273-278K → C6H5-N≡N-Cl (Benzene Diazonium Chloride)`

> *Explanation: Benzamide (C7) undergoes Hoffmann bromamide rearrangement with Br2/NaOH — the -CO- is lost, giving aniline (C6). Note: this is one of the few reactions that reduce carbon count. Aniline then diazotises to form the diazonium salt at 273-278K.*

Answer Summary:

Label	Formula	Name
A	`C6H5NH2`	**Aniline**
B	`C6H5N2Cl`	**Benzene Diazonium Chloride**

Q13. *C6H5-NO2 → A (Fe/HCl) → B (HNO2) → C (C6H5OH)*

Named Reaction: Reduction + Diazotisation + Azo Coupling

Reactions:

Step	Reaction
A	`C6H5-NO2 + Fe/HCl → C6H5-NH2 (Aniline)`
B	`C6H5-NH2 + HNO2 → C6H5-N=N-Cl (Benzene Diazonium Chloride)`
C	`C6H5-N2Cl + C6H5OH → C6H5-N=N-C6H4-OH (p-Hydroxy azobenzene)`

> *Explanation: Fe/HCl reduces nitrobenzene to aniline. Aniline diazotised with HNO2 (= NaNO2 + HCl). The diazonium salt couples with phenol (at para position) at pH 9-10 to give p-hydroxy azobenzene — an orange-yellow azo dye.*

Answer Summary:

Label	Formula	Name
A	`C6H5NH2`	**Aniline**
B	`C6H5N2Cl`	**Benzene Diazonium Chloride**

C	C6H5-N=N-C6H4-OH	**p-Hydroxy Azobenzene (Azo Dye)**

Q14. *C6H5-OH → A (Zn) → B (CH3Cl/AlCl3) → C (O/KMnO4)*

Named Reaction: Reduction + Friedel-Crafts + Oxidation

Reactions:

Step	Reaction
A	C6H5-OH + Zn → C6H6 (Benzene)
B	C6H6 + CH3Cl/AlCl3 → C6H5-CH3 (Toluene) [Friedel-Crafts Alkylation]
C	C6H5-CH3 + (O)/KMnO4 → C6H5-COOH (Benzoic acid) [Side-chain oxidation]

> *Explanation: Phenol reduces to benzene with Zn. Friedel-Crafts alkylation adds a methyl group to give toluene. Hot acidic KMnO4 oxidises the entire methyl group to -COOH regardless of chain length, giving benzoic acid.*

Answer Summary:

Label	Formula	Name
A	C6H6	**Benzene**
B	C6H5CH3	**Toluene**
C	C6H5COOH	**Benzoic Acid**

Q15. *Cyclohexanone + methylenecyclohexylamine, trace H+*

Named Reaction: Schiff's Base Formation

Reactions:

Step	Reaction
Product	Cyclohexanone + H2N-CH2-[ring] + trace H+ → Schiff's base (ring=N-CH2-[ring]) + H2O

> *Explanation: A Schiff's base (imine) is formed by condensation of a carbonyl compound (aldehyde or ketone) with a primary amine. Water is eliminated. Trace acid catalyses the reaction. General form: R-CHO + H2N-R' → R-CH=N-R' + H2O.*

Answer Summary:

Label	Formula	Name
Product	`R-C=N-CH2-R'`	**Schiff's Base (Aldimine / Ketimine)**

Q16. *C6H5-NH2 + C6H5-CHO → ?*

Named Reaction: Schiff's Base Formation from Aniline + Benzaldehyde

Reactions:

Step	Reaction
Product	`C6H5-CHO + H2N-C6H5 + H+ → C6H5-CH=N-C6H5 + H2O  (Benzal aniline)`

> *Explanation: Benzaldehyde (aromatic aldehyde) condenses with aniline (primary aromatic amine) to form benzal aniline — an aromatic Schiff's base. Acid catalysis helps. Water is lost in this condensation. Schiff's bases are used as ligands and dyes.*

Answer Summary:

Label	Formula	Name
Product	`C6H5-CH=N-C6H5`	**Benzal Aniline (Schiff's Base)**

Q17. *C6H5-NH2 + C6H5-COCl → ? (Pyridine)*

Named Reaction: Schotten-Baumann Reaction (N-Acylation)

Reactions:

Step	Reaction
Product	`C6H5-COCl + H2N-C6H5 + Pyridine → C6H5-CO-NH-C6H5 + HCl`

> *Explanation: Aniline (nucleophile) reacts with benzoyl chloride (electrophile) in the presence of pyridine (base — neutralises HCl) to form N-phenyl benzamide. This is Schotten-Baumann condition. Pyridine prevents the HCl produced from reacting with amine.*

Answer Summary:

Label	Formula	Name
Product	`C6H5-CO-NH-C6H5`	**N-Phenyl Benzamide**

Q18. *CH3CH2NC → A (HgO) → B (H2O) → C (NaNO2-HCl/H2O)*

Named Reaction: Isocyanide Hydrolysis + Diazotisation → Alcohol

Reactions:

Step	Reaction
A	`CH3CH2NC + HgO → CH3CH2-N=C=O (Ethyl isocyanate)`
B	`CH3CH2-N=C=O + H2O → CH3CH2-NH2 (Ethylamine)`
C	`CH3CH2-NH2 + NaNO2/HCl/H2O → CH3CH2-OH (Ethyl alcohol) + N2`

> *Explanation: Ethyl isocyanide oxidised by HgO gives ethyl isocyanate. Hydrolysis of isocyanate gives ethylamine. Diazotisation of primary aliphatic amine with NaNO2/HCl gives unstable diazonium salt which immediately decomposes to alcohol + N2.*

Answer Summary:

Label	Formula	Name
A	`CH3CH2NCO`	**Ethyl Isocyanate**
B	`CH3CH2NH2`	**Ethylamine**
C	`CH3CH2OH`	**Ethyl Alcohol**

Q19. *Glutaric acid → A (SOCl2) → B (NH3) → C (LiAlH4)*

Named Reaction: Acid Chloride → Amide → Amine (LiAlH4 Reduction)

Reactions:

Step	Reaction

A	Glutaric acid + SOCl2 → Glutaryl dichloride (Glycocyl chloride)
B	Glutaryl dichloride + NH3 → Glutaramide (Glutamide)
C	Glutamide + LiAlH4 → Pentan-1,5-diamine [Reduction of amide to amine]

> *Explanation: Dicarboxylic acid reacts with SOCl2 to give diacid chloride. Reaction with ammonia gives diamide. LiAlH4 is a powerful reducing agent that converts amide (-CONH2) to amine (-CH2NH2). Product is a diamine (1,5-pentanediamine).*

Answer Summary:

Label	Formula	Name
A	ClCO(CH2)3COCl	**Glutaryl Dichloride (Glycocyl Chloride)**
B	H2NOC(CH2)3CONH2	**Glutaramide (Glutamide)**
C	H2N(CH2)5NH2	**Pentan-1,5-diamine**

Q20. *C6H5-N2Cl coupling with three different compounds*

Named Reaction: Azo Coupling Reactions (pH dependent)

Reactions:

Step	Reaction
A	C6H5N2Cl + p-N(CH3)2-C6H4 → p-(CH3)2N-C6H4-N=N-C6H5 [p-N,N-dimethylaminoazobenzene]
B	C6H5N2Cl + p-CH3-C6H4-OH → p-CH3-C6H4(N=N-C6H5)-OH [2-Phenylazo-4-methylphenol]
C	C6H5N2Cl + p-NH2-C6H4 → p-NH2-C6H4-N=N-C6H5 [p-Aminoazobenzene]

> *Explanation: Diazonium salt couples with aromatic amines (pH 4-5) and phenols (pH 9-10). N,N-dimethylaniline couples at para to give orange azo dye (A). p-cresol gives 2-phenylazo-4-methylphenol (B). p-aminoaniline gives p-aminoazobenzene (C). Azo dyes are coloured due to -N=N- chromophore.*

Answer Summary:

Label	Formula	Name
A	p-(CH3)2N-C6H4-N=N-C6H5	**p-N,N-Dimethylaminoazobenzene**

B	CH3-C6H3(OH)-N=N-C6H5	**2-Phenylazo-4-methylphenol**
C	p-NH2-C6H4-N=N-C6H5	**p-Aminoazobenzene**

Q21. *A → CH3CH2NH2 and B → CH3NHCH3 with Na-Hg/C2H5OH*

Named Reaction: Reduction of Cyanide vs Isocyanide

Reactions:

Step	Reaction
A	CH3-CN + Na-Hg/C2H5OH → CH3-CH2-NH2 (Ethylamine — 1° amine)
B	CH3-NC + Na-Hg/C2H5OH → CH3-NH-CH3 (Dimethylamine — 2° amine)

> *Explanation: Key distinction: Cyanide (R-CN) on reduction gives PRIMARY amine (chain extended). Isocyanide (R-NC) on reduction gives SECONDARY amine (chain not extended, N inserted between carbons). This is how you distinguish cyanide from isocyanide.*

Answer Summary:

Label	Formula	Name
A	CH3-CN	**Methyl Cyanide (Acetonitrile)**
B	CH3-NC	**Methyl Isocyanide**

Q22. *CH3CONH2 → A (Br2/NaOH) → B (NaNO2/HCl) → C (O then NH3)*

Named Reaction: Hoffmann → Diazotisation → Urotropine Formation

Reactions:

Step	Reaction
A	CH3CONH2 + Br2/NaOH → CH3NH2 (Methylamine) [Hoffmann Bromamide]
B	CH3NH2 + NaNO2/HCl → CH3OH (Methyl alcohol) + N2
C	HCHO + (O) → HCHO; 6HCHO + 4NH3 → (CH2)6N4 + 6H2O (Urotropine)

Explanation: Acetamide loses CO via Hoffmann bromamide to give methylamine (C2→C1). Methylamine with NaNO2/HCl gives methyl alcohol. Oxidation of methanol gives formaldehyde. 6HCHO + 4NH3 condense to hexamethylenetetramine (Urotropine — used as antiseptic).

Answer Summary:

Label	Formula	Name
A	CH3NH2	**Methylamine**
B	CH3OH	**Methyl Alcohol**
C	(CH2)6N4	**Urotropine (Hexamethylenetetramine)**

Q23. *Anisole + t-butyl chloride/AlCl3 → A; A + Cl2/FeCl3 → B*

Named Reaction: Friedel-Crafts Alkylation + Electrophilic Chlorination

Reactions:

Step	Reaction
A	Anisole + (CH3)3C-Cl/AlCl3 → 4-t-butyl-1-methoxybenzene [Friedel-Crafts]
B	4-t-butyl-1-methoxybenzene + Cl2/FeCl3 → 2-Chloro-4-t-butyl-1-methoxybenzene

Explanation: Anisole (-OCH3 group) is an ortho/para director. t-Butyl group adds at para position (Friedel-Crafts). Second electrophilic substitution by Cl2/FeCl3 adds Cl at ortho to -OCH3 (position 2), since para is already occupied by t-butyl.

Answer Summary:

Label	Formula	Name
A	(CH3)3C-C6H4-OCH3	**4-t-Butyl-1-methoxybenzene**
B	Cl-(CH3)3C-C6H3-OCH3	**2-Chloro-4-t-butyl-1-methoxybenzene**

Q24. *CH3-CHO + HCN → A; A + H2O/H+ → B; A + LiAlH4 → C*

Named Reaction: Cyanohydrin Formation + Hydrolysis + LiAlH4 Reduction

Reactions:

Step	Reaction
A	CH3-CHO + HCN → CH3-CH(OH)-CN (Acetaldehyde cyanohydrin)
B	CH3-CH(OH)-CN + H2O/H+ → CH3-CH(OH)-COOH (Lactic acid) [Hydrolysis]
C	CH3-CH(OH)-CN + LiAlH4 → CH3-CH(OH)-CH2-NH2 (1-Amino-2-propanol)

> *Explanation: HCN (nucleophile) adds to acetaldehyde's carbonyl carbon to form cyanohydrin. Acid hydrolysis converts -CN to -COOH giving lactic acid (found in sour milk). LiAlH4 reduces -CN to -CH2NH2 without touching -OH, giving an amino alcohol.*

Answer Summary:

Label	Formula	Name
A	CH3CH(OH)CN	**Acetaldehyde Cyanohydrin**
B	CH3CH(OH)COOH	**Lactic Acid (2-Hydroxy Propanoic Acid)**
C	CH3CH(OH)CH2NH2	**1-Amino-2-propanol**

Q25. *C6H5-OH with i)NaOH ii)CO2 iii)H2O/H+ → X; and CHCl3/NaOH → Y*

Named Reaction: Kolbe's Reaction + Reimer-Tiemann Reaction

Reactions:

Step	Reaction
X	C6H5OH + NaOH → C6H5ONa; + CO2/pressure → sodium salicylate; + H+/H2O → Salicylic acid (X)
Y	C6H5OH + CHCl3/NaOH → 2-HO-C6H4-CHO (Salicylaldehyde Y) [Reimer-Tiemann]

> *Explanation: Both Kolbe's and Reimer-Tiemann introduce substituents ortho to -OH in phenol. Kolbe's uses CO2 under pressure → -COOH group. Reimer-Tiemann uses CHCl3/NaOH (dichlorocarbene intermediate) → -CHO group.*

Answer Summary:

Label	Formula	Name
X	2-HO-C6H4-COOH	**Salicylic Acid (Kolbe's Reaction)**

Y	2-HO-C6H4-CHO	**Salicylaldehyde (Reimer-Tiemann Reaction)**

Q26. *Benzene → A (HNO3/H2SO4) → B (Sn/HCl) → C (NaNO2/HCl)*

Named Reaction: Nitration + Reduction + Diazotisation

Reactions:

Step	Reaction
A	C6H6 + conc.HNO3/conc.H2SO4 → C6H5-NO2 (Nitrobenzene)
B	C6H5-NO2 + Sn/HCl → C6H5-NH2 (Aniline)
C	C6H5-NH2 + NaNO2/HCl → C6H5-N2Cl (Benzene Diazonium Chloride)

> *Explanation: Benzene undergoes electrophilic aromatic nitration with mixed acid (HNO3+H2SO4) giving nitrobenzene. Reduction by Sn/HCl gives aniline. Diazotisation at 273-278K gives benzene diazonium chloride — a key intermediate in synthesis.*

Answer Summary:

Label	Formula	Name
A	C6H5NO2	**Nitrobenzene**
B	C6H5NH2	**Aniline**
C	C6H5N2Cl	**Benzene Diazonium Chloride**

Q27. *CH3-COCl → A (Pd/BaSO4) → B (NaOH) → C (heat)*

Named Reaction: Rosenmund Reduction + Aldol Condensation + Dehydration

Reactions:

Step	Reaction
A	CH3-COCl + Pd/BaSO4/H2 → CH3-CHO (Acetaldehyde) [Rosenmund]
B	2CH3-CHO + dil.NaOH → CH3CH(OH)CH2CHO (Aldol / 3-Hydroxybutanal)

C	`CH3CH(OH)CH2CHO + heat → CH3-CH=CH-CHO + H2O (Crotonaldehyde / But-2-enal)`

> *Explanation: Rosenmund reduces acid chloride to aldehyde (Pd/BaSO4 prevents over-reduction). Aldol condensation gives 3-hydroxybutanal (Aldol). On heating, aldol dehydrates to give crotonaldehyde (conjugated aldehyde — alpha,beta-unsaturated).*

Answer Summary:

Label	Formula	Name
A	`CH3CHO`	**Acetaldehyde**
B	`CH3CH(OH)CH2CHO`	**Aldol (3-Hydroxybutanal)**
C	`CH3CH=CHCHO`	**Crotonaldehyde (But-2-enal)**

Q28. *NH3 with HCHO, CH3-CHO, and C6H5-CHO*

Named Reaction: Amine Condensation with Aldehydes

Reactions:

Step	Reaction
A	`6HCHO + 4NH3 → (CH2)6N4 + 6H2O  (Hexamethylenetetramine / Urotropine)`
B	`CH3-CHO + NH3 → CH3-CH=NH (Aldimine / Ethylideneamine)`
C	`3C6H5-CHO + 2NH3 → C6H5-CH=N-CH(C6H5)-N=CH-C6H5  (Hydrobenzamide)`

> *Explanation: Different aldehydes react differently with NH3. HCHO (excess) with NH3 forms urotropine (cage compound). Acetaldehyde with NH3 forms simple aldimine. Benzaldehyde (3:2 ratio) forms hydrobenzamide (a trimer-like Schiff's base).*

Answer Summary:

Label	Formula	Name
A	`(CH2)6N4`	**Hexamethylenetetramine (Urotropine)**
B	`CH3-CH=NH`	**Aldimine (Ethylideneamine)**
C	`(C6H5CH=N)2CHCH6H5`	**Hydrobenzamide**

Q29. *C_2H_6O (A) → B (Cu) → C (N_2H_4/C_2H_5ONa)*

Named Reaction: Oxidative Dehydrogenation + Wolff-Kishner Reduction

Reactions:

Step	Reaction
A	CH_3CH_2OH (Ethyl Alcohol)
B	CH_3CH_2OH + Cu/heat → CH_3CHO (Acetaldehyde) [Dehydrogenation]
C	CH_3CHO + N_2H_4/C_2H_5ONa → CH_3CH_3 (Ethane) [Wolff-Kishner Reduction]

> *Explanation: Ethanol dehydrogenates over copper to give acetaldehyde. Wolff-Kishner reduction (hydrazine + base) converts the aldehyde carbonyl to $-CH_2-$ giving ethane. This converts oxygenated compound to hydrocarbon.*

Answer Summary:

Label	Formula	Name
A	CH_3CH_2OH	**Ethyl Alcohol**
B	CH_3CHO	**Acetaldehyde**
C	CH_3CH_3	**Ethane**

Q30. *CH_3COCH_3 with Zn/Hg and Mg/Hg*

Named Reaction: Clemmensen Reduction vs Pinacol Coupling

Reactions:

Step	Reaction
A	CH_3COCH_3 + Zn-Hg/HCl → $CH_3CH_2CH_3$ (Propane) [Clemmensen — C=O → CH_2]
B	2 CH_3COCH_3 + Mg/Hg → $(CH_3)_2C(OH)-C(OH)(CH_3)_2$ [Pinacol — 2,3-Dimethylbutane-2,3-diol]

> *Explanation: Clemmensen (Zn-Hg/HCl) removes the carbonyl oxygen giving propane (full reduction). Mg/Hg is used for pinacol coupling — two ketone molecules couple reductively to give a 1,2-diol called pinacol. Two different reducing methods, two different products!*

Answer Summary:

Label	Formula	Name
A	`CH3CH2CH3`	**Propane (Clemmensen Reduction)**
B	`(CH3)2C(OH)C(OH)(CH3)2`	**Pinacol (2,3-Dimethylbutane-2,3-diol)**

Q31. *C6H5-NO2 with HNO3/H2SO4 at 373K and 473K*

Named Reaction: Temperature-Controlled Polynitration

Reactions:

Step	Reaction
A	`C6H5NO2 + HNO3/H2SO4 at 373K → 1,3-Dinitrobenzene (m-dinitrobenzene)`
B	`1,3-C6H4(NO2)2 + HNO3/H2SO4 at 473K → 1,3,5-Trinitrobenzene (TNB)`

> *Explanation: Nitrobenzene's -NO2 group deactivates the ring (meta director). A second nitro group enters at meta position at 373K. At higher temperature (473K) a third nitro group is introduced. 1,3,5-Trinitrobenzene (TNB) is an explosive.*

Answer Summary:

Label	Formula	Name
A	`1,3-C6H4(NO2)2`	**m-Dinitrobenzene (1,3-Dinitrobenzene)**
B	`1,3,5-C6H3(NO2)3`	**1,3,5-Trinitrobenzene (TNB)**

Q32. *Glycol with anhydrous ZnCl2 and conc.H2SO4*

Named Reaction: Dehydration of Glycol

Reactions:

Step	Reaction
A	CH2(OH)-CH2(OH) + anhydrous ZnCl2 → CH3-CHO (Acetaldehyde) [Intramolecular dehydration]
B	2 CH2(OH)-CH2(OH) + conc.H2SO4 → 1,4-Dioxane (cyclic ether) [Intermolecular]

> *Explanation: Glycol (ethane-1,2-diol) with ZnCl2 undergoes intramolecular dehydration rearranging to acetaldehyde. With conc. H2SO4, two molecules undergo intermolecular dehydration to form 1,4-dioxane (cyclic diether — 6-membered ring with 2 oxygens).*

Answer Summary:

Label	Formula	Name
A	CH3CHO	**Acetaldehyde (ZnCl2, intramolecular)**
B	1,4-dioxane	**1,4-Dioxane (H2SO4, intermolecular)**

Q33. *Glycol with HIO4 and PI3*

Named Reaction: Glycol Cleavage (HIO4) and Deoxygenation (PI3)

Reactions:

Step	Reaction
A	HOCH2-CH2OH + HIO4 → 2 HCHO (Formaldehyde) [Glycol cleavage]
B	HOCH2-CH2OH + PI3 → CH2=CH2 (Ethylene) [Dehydration / deoxygenation]

> *Explanation: HIO4 (periodic acid) cleaves the C-C bond of vicinal diol, giving 2 moles of formaldehyde (one per carbon). PI3 converts the two -OH groups to iodide and eliminates to give ethylene. This is a key diagnostic test for 1,2-diol (vicinal diol).*

Answer Summary:

Label	Formula	Name
A	2 HCHO	**Formaldehyde (x2) [HIO4 cleavage]**
B	CH2=CH2	**Ethylene [PI3 elimination]**

Q34. *C2H5-OH with H2SO4 at 413K and 443K*

Named Reaction: Temperature-Dependent Dehydration of Ethanol

Reactions:

Step	Reaction
A	`C2H5OH + H2SO4 at 413K → C2H5-O-C2H5 (Diethyl Ether) [Intermolecular]`
B	`C2H5OH + H2SO4 at 443K → CH2=CH2 (Ethylene) [Intramolecular]`

> *Explanation: Temperature determines the product: 413K → bimolecular (ether formation). 443K → unimolecular (elimination to alkene). At lower temp., two alcohol molecules react. At higher temp., single molecule loses water. This is a classic temperature-controlled reaction.*

Answer Summary:

Label	Formula	Name
A	C2H5OC2H5	**Diethyl Ether (Ethoxyethane) [413K]**
B	CH2=CH2	**Ethylene (Ethene) [443K]**

Q35. *Diethyl ether with PCl5 and dil. H2SO4*

Named Reaction: Ether Cleavage Reactions

Reactions:

Step	Reaction
A	`C2H5-O-C2H5 + PCl5 → 2 C2H5Cl (Ethyl chloride) + POCl3`
B	`C2H5-O-C2H5 + dil.H2SO4 → 2 C2H5OH (Ethyl alcohol)`

> *Explanation: Diethyl ether is cleaved by PCl5 — the oxygen is replaced by two Cl atoms giving ethyl chloride. Dilute H2SO4 hydrolyses (cleaves) the ether's C-O bond with water to give ethanol. Ethers are generally resistant to acids but HI and PCl5 can cleave them.*

Answer Summary:

Label	Formula	Name

A	`C2H5Cl`	**Ethyl Chloride (PCl5 cleavage)**
B	`C2H5OH`	**Ethyl Alcohol (H2SO4 hydrolysis)**

Q36. *C6H5-CHO with alc.KCN and NaOH*

Named Reaction: Benzoin Condensation + Cannizzaro Reaction

Reactions:

Step	Reaction
A	`2 C6H5-CHO + alc.KCN → C6H5-CH(OH)-CO-C6H5  (Benzoin)  [Benzoin Condensation]`
B,C	`2 C6H5-CHO + NaOH → C6H5CH2OH (Benzyl alcohol B) + C6H5COONa (Sodium benzoate C)  [Cannizzaro]`

> *Explanation: Two different reactions of benzaldehyde. KCN catalyses benzoin condensation — one molecule acts as nucleophile (after CN addition) and attacks the other; product is benzoin (alpha-hydroxy ketone). NaOH causes Cannizzaro disproportionation (no alpha-H).*

Answer Summary:

Label	Formula	Name
A	`C6H5CH(OH)COC6H5`	**Benzoin**
B	`C6H5CH2OH`	**Benzyl Alcohol (Cannizzaro)**
C	`C6H5COONa`	**Sodium Benzoate (Cannizzaro)**

Q37. *CH3-COOH with HI/red P and Cl2/red P*

Named Reaction: Hell-Volhard-Zelinsky (HVZ) Reaction + HI Reduction

Reactions:

Step	Reaction
A	`CH3-COOH + HI/red P → CH3-CH3 (Ethane)  [Reduction of acid]`

B	CH3-COOH + Cl2/red P → Cl-CH2-COOH (Monochloroacetic acid) [HVZ Reaction]

> *Explanation: HI reduces acetic acid all the way to ethane (COOH → CH3). Red P + Cl2 halogenates at alpha-carbon (Hell-Volhard-Zelinsky reaction) — red P converts Cl2 to PCl3 which activates the acid. Alpha-H is replaced by Cl to give chloroacetic acid.*

Answer Summary:

Label	Formula	Name
A	CH3CH3	**Ethane (HI reduction)**
B	ClCH2COOH	**Monochloroacetic Acid (HVZ Reaction)**

Q38. *A and B are isomers: A with H2O/H+ gives CH3COOH; B gives CH3CH2OH*

Named Reaction: Hydrolysis of Nitroalkane vs Alkyl Nitrite

Reactions:

Step	Reaction
A	CH3CH2NO2 + H2O/H+ → CH3COOH (Acetic acid) [Nitroethane — C-N bond]
B	CH3CH2-O-N=O + H2O/H+ → CH3CH2OH (Ethanol) [Ethyl nitrite — O-N bond]

> *Explanation: Nitroethane (R-NO2 — C bonded to N) on hydrolysis gives acetic acid. Ethyl nitrite (R-O-N=O — O bonded to N) on hydrolysis gives ethanol. Both have formula C2H5NO2 — same molecular formula, structural isomers. Key: C-N vs O-N bond determines product.*

Answer Summary:

Label	Formula	Name
A	CH3CH2NO2	**Nitroethane**
B	CH3CH2ONO	**Ethyl Nitrite**

Q39. *A and B are isomers: A + Sn/HCl → CH3CH2NH2; B → CH3CH2OH*

Named Reaction: Reduction of Nitroalkane vs Alkyl Nitrite

Reactions:

Step	Reaction
A	CH3CH2NO2 + Sn/HCl → CH3CH2NH2 (Ethylamine) [Nitroethane — NO2 reduces to NH2]
B	CH3CH2-O-N=O + Sn/HCl → CH3CH2OH (Ethanol) [Ethyl nitrite — O-N bond cleaves]

> *Explanation: Same structural isomers as Q38 but with Sn/HCl. Nitroethane's -NO2 reduces to -NH2 giving ethylamine. Ethyl nitrite's O-N bond cleaves to give ethanol. The difference in bonding (C-N vs O-N) leads to different products under the same conditions.*

Answer Summary:

Label	Formula	Name
A	CH3CH2NO2	**Nitroethane → Ethylamine**
B	CH3CH2ONO	**Ethyl Nitrite → Ethanol**

Q40. *CH3-Br + NaN3 → A; A + LiAlH4 → B + N2*

Named Reaction: Azide Formation + Reduction to Amine

Reactions:

Step	Reaction
A	CH3-Br + NaN3 → CH3-N3 (Methyl azide) [SN2 substitution]
B	CH3-N3 + LiAlH4 → CH3-NH2 + N2 (Methylamine) [Reduction]

> *Explanation: Bromomethane undergoes SN2 with NaN3 (sodium azide) to give methyl azide (organic azide R-N3). LiAlH4 reduces the azide — the N=N=N group loses N2 and the remaining N bonds to H, giving methylamine (primary amine).*

Answer Summary:

Label	Formula	Name
A	CH3N3	**Methyl Azide**
B	CH3NH2	**Methylamine**

Q41. *CH3CH2Br with KCN and AgCN/C2H5OH*

Named Reaction: KCN vs AgCN — Cyanide vs Isocyanide formation

Reactions:

Step	Reaction
A	CH3CH2Br + KCN → CH3CH2CN (Ethyl cyanide) [C-attack, SN2]
B	CH3CH2Br + AgCN/C2H5OH → CH3CH2NC (Ethyl isocyanide) [N-attack]

> *Explanation: KCN is ionic — CN- is a good nucleophile, attacks via carbon to give cyanide (R-CN). AgCN is covalent — nitrogen attacks alkyl halide to give isocyanide (R-NC). Same reagent (CN), different bonding: K gives C-alkylation; Ag gives N-alkylation.*

Answer Summary:

Label	Formula	Name
A	CH3CH2CN	**Ethyl Cyanide (Propanenitrile) [KCN]**
B	CH3CH2NC	**Ethyl Isocyanide [AgCN]**

Q42. *CH3CH2NH2 with NaNO2/HCl and CHCl3/KOH*

Named Reaction: Diazotisation of Aliphatic Amine + Carbylamine Test

Reactions:

Step	Reaction
A	CH3CH2NH2 + NaNO2/HCl → CH3CH2OH (Ethanol) + N2 [Aliphatic diazonium — unstable]
B	CH3CH2NH2 + CHCl3/KOH → CH3CH2NC (Ethyl isocyanide — foul smell) [Carbylamine test]

> *Explanation: Aliphatic primary amines with NaNO2/HCl form unstable diazonium salts that immediately decompose to alcohol + N2 (unlike aromatic amines). CHCl3/KOH is the carbylamine test — characteristic foul smell of isocyanide confirms primary amine.*

Answer Summary:

Label	Formula	Name
A	CH_3CH_2OH	**Ethanol (unstable aliphatic diazonium decomposition)**
B	CH_3CH_2NC	**Ethyl Isocyanide (carbylamine test — foul smell)**

Q43. *$C_6H_5N_2Cl$ with C_6H_5OH and C_6H_6/NaOH*

Named Reaction: Azo Coupling + Gomberg-Bachmann Reaction

Reactions:

Step	Reaction
A	$C_6H_5N_2Cl + C_6H_5\text{-}OH \rightarrow C_6H_5\text{-}N{=}N\text{-}C_6H_4\text{-}OH$ (p-Hydroxy azobenzene) [Azo coupling]
B	$C_6H_5N_2Cl + C_6H_6/KOH \rightarrow C_6H_5\text{-}C_6H_5$ (Biphenyl) + HCl + N_2 [Gomberg-Bachmann]

> *Explanation: Diazonium salt can undergo two reactions. With phenol at pH 9-10, electrophilic coupling gives azo dye. With benzene/KOH (Gomberg-Bachmann reaction), the diazonium forms phenyl radical which attacks benzene ring to give biphenyl.*

Answer Summary:

Label	Formula	Name
A	$C_6H_5\text{-}N{=}N\text{-}C_6H_4\text{-}OH$	**p-Hydroxy Azobenzene (Azo Coupling)**
B	$C_6H_5\text{-}C_6H_5$	**Biphenyl (Gomberg-Bachmann Reaction)**

Q44. *$C_6H_5\text{-}COOH$ with HNO_3/H_2SO_4 and Fuming H_2SO_4*

Named Reaction: Electrophilic Nitration + Sulphonation of Benzoic Acid

Reactions:

Step	Reaction
A	$C_6H_5\text{-}COOH$ + conc.HNO_3/conc.H_2SO_4 $\rightarrow$ m-$NO_2\text{-}C_6H_4\text{-}COOH$ (m-Nitrobenzoic acid)

B	C6H5-COOH + fuming H2SO4 → m-SO3H-C6H4-COOH (m-Sulphobenzoic acid)

> *Explanation: Benzoic acid's -COOH group is an electron-withdrawing meta director. Both nitration and sulphonation give meta products. Fuming H2SO4 (oleum) introduces -SO3H. Both reactions follow EAS (electrophilic aromatic substitution) with meta selectivity.*

Answer Summary:

Label	Formula	Name
A	m-NO2-C6H4-COOH	**m-Nitrobenzoic Acid**
B	m-SO3H-C6H4-COOH	**m-Sulphobenzoic Acid**

Q45. *Acetyl chloride + CH3MgBr → X; X + acidic K2Cr2O7 → A*

Named Reaction: Grignard Addition to Acid Chloride + Oxidation

Reactions:

Step	Reaction
X	CH3COCl + CH3MgBr → CH3COCH3 (Acetone) + MgClBr [Grignard adds to acyl chloride]
A	CH3COCH3 + acidic K2Cr2O7 → CH3COOH (Acetic acid) [Oxidation of ketone]

> *Explanation: Grignard reagent adds to acetyl chloride — the CH3- (carbanion) attacks the carbonyl carbon, and after elimination of MgClBr, acetone forms. Acidic K2Cr2O7 oxidises acetone to acetic acid (oxidative cleavage of ketone at lower carbon).*

Answer Summary:

Label	Formula	Name
X	CH3COCH3	**Acetone (Propanone)**
A	CH3COOH	**Acetic Acid (Ethanoic Acid)**

Q46. *2-Methylbut-2-ene + i)O3 ii)Zn/H2O; and CH3COCH3 + Mg/Hg*

Named Reaction: Ozonolysis + Pinacol Coupling

Reactions:

Step	Reaction
x	CH3-CH=C(CH3)-CH3 + O3 → [ozonide] + Zn/H2O → CH3CHO + CH3COCH3 (Ethanal + Propanone)
y	2 CH3COCH3 + Mg/Hg → (CH3)2C(OH)-C(OH)(CH3)2 (Pinacol)

> *Explanation: Ozonolysis cleaves the C=C bond. Each carbon of the double bond gets an oxygen — left carbon (CH3-CH=) gives ethanal, right carbon (=C(CH3)2) gives propanone. Pinacol coupling: Mg/Hg reduces two ketone carbonyls and they couple to give diol.*

Answer Summary:

Label	Formula	Name
x-products	CH3CHO + CH3COCH3	**Ethanal + Propanone (Ozonolysis)**
y	(CH3)2C(OH)C(OH)(CH3)2	**Pinacol (2,3-Dimethylbutane-2,3-diol)**

Q47. *C3H8O3 (A) oxidised by Fenton's reagent → B and C*

Named Reaction: Fenton's Reagent Oxidation of Glycerol (Paragraph type)

Reactions:

Step	Reaction
A	A = CH2OH-CHOH-CH2OH (Glycerol) — sweetening agent, trihydric alcohol
A→B	Glycerol + [O] → CHO-CHOH-CH2OH (Glyceraldehyde / 2,3-Dihydroxypropanal)
A→C	Glycerol + [O] → CH2OH-CO-CH2OH (Dihydroxyacetone / 1,3-Dihydroxypropan-2-one)

> *Explanation: Glycerol (C3H8O3) is a sweet-tasting trihydric alcohol used as sweetening agent and in cosmetics. Fenton's reagent (FeSO4 + H2O2) oxidises either the terminal or central carbon. Oxidation of end carbon gives glyceraldehyde (aldose type). Oxidation of central carbon gives dihydroxyacetone (ketose type).*

Answer Summary:

Label	Formula	Name

A	$HOCH_2CH(OH)CH_2OH$	**Glycerol (Propane-1,2,3-triol)**
B	$CHO-CHOH-CH_2OH$	**Glyceraldehyde (2,3-Dihydroxypropanal)**
C	$CH_2OH-CO-CH_2OH$	**Dihydroxyacetone (1,3-Dihydroxypropan-2-one)**

Q48. *C_2H_3N (A) → C_2H_7N (B) → C_2H_6O (C) — paragraph type*

Named Reaction: Cyanide Reduction + Carbylamine Test + Diazotisation

Reactions:

Step	Reaction
A	A = CH_3-CN (Methyl cyanide, C_2H_3N) — nitrile
A→B	$CH_3-CN + Na\text{-}Hg/C_2H_5OH \rightarrow CH_3-CH_2-NH_2$ (Ethylamine, C_2H_7N)
B test	$CH_3CH_2NH_2 + CHCl_3/KOH \rightarrow CH_3CH_2NC$ (Isocyanide — foul smell, carbylamine test positive)
B→C	$CH_3CH_2NH_2 + HNO_2 \rightarrow CH_3CH_2OH$ (Ethyl alcohol, C_2H_6O) + N_2

> *Explanation: Methyl cyanide (A) reduces to ethylamine (B). Ethylamine gives positive carbylamine test (foul smelling isocyanide) confirming it's a primary amine. Ethylamine with HNO_2 (= $NaNO_2$+HCl, aliphatic diazotisation) gives unstable diazonium → ethyl alcohol + N_2.*

Answer Summary:

Label	Formula	Name
A	CH_3-CN	**Methyl Cyanide (C_2H_3N)**
B	$CH_3CH_2NH_2$	**Ethylamine (C_2H_7N)**
C	CH_3CH_2OH	**Ethyl Alcohol (C_2H_6O)**

Q49. *C_6H_6 (A) + propylene → B → C ($C_9H_{12}O_2$) → D — paragraph type*

Named Reaction: Cumene Process (Industrial Phenol Production)

Reactions:

Step	Reaction
A	A = C6H6 (Benzene)
A→B	C6H6 + CH3CH=CH2 + H3PO4/523K → C6H5CH(CH3)2 (Cumene)
B→C	Cumene + Air/O2 + 5% aq. Na2CO3 → C6H5C(CH3)2OOH (Cumene Hydroperoxide, C9H12O2)
C→D	C6H5C(CH3)2OOH + H2SO4 → C6H5OH (Phenol) + CH3COCH3 (Acetone)

> *Explanation: Cumene process is the industrial method for phenol production. Benzene alkylated with propylene gives cumene. Air oxidation in alkaline medium gives cumene hydroperoxide. Acid cleavage simultaneously gives phenol AND acetone (both are commercially valuable). This is an atom-efficient process.*

Answer Summary:

Label	Formula	Name
A	C6H6	**Benzene**
B	C6H5CH(CH3)2	**Cumene (Isopropylbenzene)**
C	C6H5C(CH3)2OOH	**Cumene Hydroperoxide**
D	C6H5OH	**Phenol (+ Acetone as by-product)**

Q50. *C2H6O (A) → C2H4 (B) → C2H6O2 (C) → C4H8O (D); A at 413K → C4H10O (E) — paragraph type*

Named Reaction: Ethanol — Complete Multi-Step Reaction Chain

Reactions:

Step	Reaction
A→B	CH3CH2OH + conc.H2SO4/443K → CH2=CH2 (Ethylene B) [Dehydration]
B→C	CH2=CH2 + alkaline KMnO4 → HOCH2CH2OH (Glycol C) [Baeyer's hydroxylation, antifreeze]
C→D	2 HOCH2CH2OH + conc.H2SO4 → 1,4-Dioxane (D, cyclic ether C4H8O)
A→E	CH3CH2OH + conc.H2SO4/413K → C2H5OC2H5 (Diethyl Ether E) [Etherification]

> *Explanation: Ethanol (A) is the starting material for many products depending on conditions: 443K gives ethylene; Baeyer's reagent gives glycol (used as antifreeze in car radiators); glycol + H_2SO_4 gives 1,4-dioxane (cyclic compound). At 413K, ethanol gives diethyl ether. This illustrates the versatility of ethanol.*

Answer Summary:

Label	Formula	Name
A	C_2H_5OH	**Ethyl Alcohol (Ethanol)**
B	$CH_2=CH_2$	**Ethylene (Ethene)**
C	$HOCH_2CH_2OH$	**Ethylene Glycol (antifreeze, $C_2H_6O_2$)**
D	`1,4-dioxane`	**1,4-Dioxane (cyclic ether, C_4H_8O)**
E	$C_2H_5OC_2H_5$	**Diethyl Ether ($C_4H_{10}O$)**

MASTER NAMED REACTIONS QUICK REFERENCE

Named Reaction	Reagent / Condition	Product / What Happens
Cannizzaro Reaction	Aldehyde without alpha-H + 50% NaOH	Disproportionation — one oxidised, one reduced
Aldol Condensation	2 Aldehydes/ketones + dil.NaOH	Beta-hydroxy aldehyde (Aldol); heating → alpha,beta-unsaturated
Grignard Reaction	RMgX (Grignard reagent) + carbonyl + H2O	Nucleophilic addition — chain extension
Dow's Process	ArCl + NaOH at high T,P	Industrial phenol from chlorobenzene
Kolbe's Reaction	ArONa + CO2 / 400K / 4-7 bar	Carboxylation of phenol → Salicylic acid
Reimer-Tiemann Reaction	Phenol + CHCl3/NaOH	Formylation of phenol → Salicylaldehyde
Friedel-Crafts Alkylation	ArH + RCl + anhydrous AlCl3	Alkyl group added to ring
Friedel-Crafts Acylation	ArH + RCOCl + anhydrous AlCl3	Acyl group added to ring — gives ketone
Cumene Process	Benzene + propylene → Cumene → Phenol	Industrial phenol + acetone co-production
Hoffmann Bromamide	Primary amide + Br2/NaOH	Amine with 1 less C (decarboxylation)
Diazotisation	Primary ArNH2 + NaNO2/HCl at 273-278K	Diazonium salt formation
Sandmeyer Reaction	ArN2Cl + CuX	Replaces -N2+ with -CN, -Cl, -Br
Gomberg-Bachmann	ArN2Cl + ArH/KOH	Coupling of two arenes via radical
Azo Coupling	ArN2Cl + phenol/amine at pH 9-10	Coloured azo dye (-N=N-)
Carbylamine Test	Primary amine + CHCl3/KOH	Foul-smelling isocyanide — test for 1° amine
Clemmensen Reduction	C=O + Zn-Hg/HCl	Reduces C=O to CH2 (acidic medium)
Wolff-Kishner Reduction	C=O + N2H4/base	Reduces C=O to CH2 (basic medium)
Rosenmund Reduction	Acid chloride + Pd/BaSO4/H2	Reduces -COCl to -CHO (selective)
HVZ Reaction	Carboxylic acid + Cl2/red P	Alpha-halogenation of carboxylic acid
Pinacol Coupling	2 Ketones + Mg/Hg	Reductive coupling → 1,2-diol (pinacol)
Benzoin Condensation	2 ArCHO + alc.KCN	Alpha-hydroxy ketone (Benzoin)

Markovnikov Addition	Alkene + HX or H2O/H+	H adds to less substituted C
Anti-Markovnikov	Alkene + B2H6/H2O2/OH-	H adds to more substituted C (hydroboration)
Schiff's Base Formation	Aldehyde/ketone + 1° amine + trace H+	Imine (C=N) formed with loss of water
Schotten-Baumann	Acid chloride + amine in pyridine	N-acylation to form amide
Baeyer's Hydroxylation	Alkene + cold alk. KMnO4 or OsO4	Syn dihydroxylation → vicinal diol
HIO4 Cleavage	Vicinal diol (1,2-diol) + HIO4	Cleaves C-C bond of diol
Ozonolysis	Alkene + O3 then Zn/H2O	Cleaves C=C to give aldehydes/ketones

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