CLASS 11 CHEMISTRY NCERT SOLUTIONS

NCERT Solutions for Class 11 Chemistry Chapter 8: Organic Chemistry – Some Basic Principles and Techniques – Free PDF Download

Contents

Chapter 8 of NCERT Class 11 Chemistry, *Organic Chemistry: Some Basic Principles and Techniques*, is the gateway chapter for everything you will study in organic chemistry across Classes 11 and 12. It explains how organic compounds are classified and named under the IUPAC system, works through the electronic effects — inductive, resonance, electromeric, and hyperconjugation — that decide how and where a molecule reacts, and introduces the laboratory techniques used to purify and analyse organic compounds: crystallisation, distillation, chromatography, Lassaigne's test, and the Dumas, Kjeldahl, and Carius methods of quantitative estimation. Below are fully worked NCERT Solutions for all 40 exercise questions of this chapter, with every IUPAC name, resonance structure, and numerical calculation derived step by step from first principles.

NCERT Solutions for Class 11 Chemistry Chapter 8: Organic Chemistry – Some Basic Principles and Techniques

Q8.1: Hybridisation states of carbon in five compounds

What are the hybridisation states of each carbon atom in the following compounds? CH2=C=O, CH3CH=CH2, (CH3)2CO, CH2=CHCN, C6H6
In **ketene, CH2=C=O**, the terminal =CH2 carbon forms one σ bond each to two H atoms and is doubly bonded to the central carbon, so it is **sp2**. The central carbon is doubly bonded to both the CH2 carbon and the oxygen (a cumulated, allene-like system), which forces it to be **sp** hybridised.
In **propene, CH3CH=CH2**: the CH3 carbon has four single bonds → **sp3**; both alkene carbons are part of a C=C double bond → **sp2** each.
In **acetone, (CH3)2CO**: the two methyl carbons are **sp3**; the carbonyl carbon (C=O) is **sp2**.
In **acrylonitrile, CH2=CH-C≡N**: the =CH2 carbon and the =CH- carbon are each **sp2**, while the nitrile carbon, triple-bonded to nitrogen, is **sp**.
In **benzene, C6H6**, every ring carbon is part of the delocalised, planar, alternating π system, so **all six carbons are sp2**.
Ketene: sp2 (CH2), sp (central C); propene: sp3, sp2, sp2; acetone: sp3, sp2, sp3; acrylonitrile: sp2, sp2, sp; benzene: all six carbons sp2.

Q8.2: Counting σ and π bonds

Indicate the σ and π bonds in: C6H6, C6H12, CH2Cl2, CH2=C=CH2, CH3NO2, HCONHCH3
Every single bond is a σ bond, and every double bond contributes one σ and one π bond.
Benzene (C6H6): 6 C-H σ + 6 C-C σ (ring) = 12 σ; the three alternating C=C bonds of the Kekulé structure give 3 π bonds.
Cyclohexane (C6H12): fully saturated → 6 C-C σ + 12 C-H σ = 18 σ, 0 π.
Dichloromethane (CH2Cl2): 2 C-H σ + 2 C-Cl σ = 4 σ, 0 π.
Allene (CH2=C=CH2): C1=C2 gives 1 σ + 1 π, C2=C3 gives another 1 σ + 1 π, plus 4 C-H σ bonds → 6 σ, 2 π.
Nitromethane (CH3NO2): 3 C-H σ + 1 C-N σ + 2 N-O σ = 6 σ; one N=O bond contributes 1 π.
N-Methylformamide (HCONHCH3): formyl C-H (1) + C-N (1) + N-H (1) + N-CH3 (1) + 3 methyl C-H (3) + the σ component of C=O (1) = 8 σ; the C=O π bond gives 1 π.
Totals — benzene: 12σ, 3π; cyclohexane: 18σ, 0π; CH2Cl2: 4σ, 0π; allene: 6σ, 2π; nitromethane: 6σ, 1π; N-methylformamide: 8σ, 1π.

Q8.3: Bond-line formulas for three compounds

Write bond line formulas for: Isopropyl alcohol, 2,3-Dimethylbutanal, Heptan-4-one.
Isopropyl alcohol is propan-2-ol, (CH3)2CHOH — a three-carbon zig-zag chain with -OH drawn on the middle (C2) vertex.
2,3-Dimethylbutanal is built on a four-carbon aldehyde chain with a methyl branch at both C2 and C3: OHC-CH(CH3)-CH(CH3)-CH3.
Heptan-4-one is a symmetrical seven-carbon ketone with the carbonyl at C4: CH3CH2CH2-CO-CH2CH2CH3 (dipropyl ketone).
Condensed formulas: (CH3)2CHOH; OHC-CH(CH3)-CH(CH3)-CH3; CH3CH2CH2COCH2CH2CH3.

Q8.4: IUPAC names of six compounds

Give the IUPAC names of the following compounds: (a) a branched heptane with two methyl substituents; (b) a bromo-substituted branched pentane; (c) a chloro, methyl-substituted hexane; (d) a branched butanol; (e) a branched butanal; (f) Cl2CHCH2OH.
Applying IUPAC rules — select the longest chain containing the principal characteristic group, number to give the lowest locants, and cite substituents alphabetically:
(a) CH3-CH(CH3)-CH2-CH2-CH(CH3)-CH2-CH3 is a seven-carbon chain with methyl groups at C2 and C5 → **2,5-Dimethylheptane**.
(b) BrCH2-CH2-CH(CH3)-CH2-CH3: the longest chain is 5 carbons with Br at C1 and a methyl at C3 → **1-Bromo-3-methylpentane**.
(c) CH3-CH2-CH(Cl)-CH(CH3)-CH2-CH3: a six-carbon chain; numbering gives Cl at C3 and CH3 at C4 → **3-Chloro-4-methylhexane**.
(d) HO-CH2-CH(CH3)-CH2-CH3: the -OH-bearing carbon must get locant 1, giving a methyl at C2 → **2-Methylbutan-1-ol**.
(e) (CH3)3C-CH2-CHO: the CHO carbon is C1, the neighbouring CH2 is C2, and the quaternary carbon is C3 → **3,3-Dimethylbutanal**.
(f) Cl2CHCH2OH: a two-carbon chain; C1 bears -OH and C2 bears two chlorines → **2,2-Dichloroethan-1-ol**.
(a) 2,5-Dimethylheptane; (b) 1-Bromo-3-methylpentane; (c) 3-Chloro-4-methylhexane; (d) 2-Methylbutan-1-ol; (e) 3,3-Dimethylbutanal; (f) 2,2-Dichloroethan-1-ol.

Q8.5: Choosing the correct IUPAC name

Which of the following represents the correct IUPAC name for the compounds concerned? (a) 2,2-Dimethylpentane or 2-Dimethylpentane (b) 2,4,7-Trimethyloctane or 2,5,7-Trimethyloctane (c) 2-Chloro-4-methylpentane or 4-Chloro-2-methylpentane (d) But-3-yn-1-ol or But-4-ol-1-yne.
(a) A multiplying prefix requires one locant for each instance → **2,2-Dimethylpentane** is correct.
(b) Comparing locant sets {2,4,7} and {2,5,7} term by term, 4 < 5, so {2,4,7} wins → **2,4,7-Trimethyloctane** is correct.
(c) Both directions give the same locant set {2,4}; when tied, the substituent cited first alphabetically (chloro before methyl) gets the lower number → **2-Chloro-4-methylpentane** is correct.
(d) The principal characteristic group (-OH) must be the terminal suffix, numbered lowest → **But-3-yn-1-ol** is correct.
Correct names: (a) 2,2-Dimethylpentane, (b) 2,4,7-Trimethyloctane, (c) 2-Chloro-4-methylpentane, (d) But-3-yn-1-ol.

Q8.6: First five members of three homologous series

Draw formulas for the first five members of each homologous series beginning with the following compounds: (a) H-COOH (b) CH3COCH3 (c) H-CH=CH2.
A homologous series is generated by repeatedly adding a -CH2- unit while keeping the functional group fixed.
(a) Carboxylic acids: **HCOOH, CH3COOH, CH3CH2COOH, CH3CH2CH2COOH, CH3CH2CH2CH2COOH**.
(b) Ketones: **CH3COCH3, CH3COCH2CH3, CH3COCH2CH2CH3, CH3CO(CH2)3CH3, CH3CO(CH2)4CH3**.
(c) Terminal alkenes: **CH2=CH2, CH3CH=CH2, CH3CH2CH=CH2, CH3CH2CH2CH=CH2, CH3CH2CH2CH2CH=CH2**.

Q8.7: Condensed and bond-line formulas with functional groups

Give condensed and bond line structural formulas and identify the functional group(s) present, if any, for:
(a) 2,2,4-Trimethylpentane (b) 2-Hydroxy-1,2,3-propanetricarboxylic acid (c) Hexanedial.
(a) **(CH3)3C-CH2-CH(CH3)-CH3** (isooctane) contains only C-C and C-H single bonds, so **no functional group is present**.
(b) Citric acid: **HOOC-CH2-C(OH)(COOH)-CH2-COOH**. Functional groups: three **carboxylic acid** groups and one tertiary **hydroxyl** group.
(c) Hexanedial: **OHC-CH2-CH2-CH2-CH2-CHO**. Functional group: two **aldehyde** groups.

Q8.8: Identifying functional groups in three natural/synthetic compounds

Identify the functional groups in the following compounds.
(a) **Vanillin** (4-hydroxy-3-methoxybenzaldehyde): a benzene ring bearing -CHO, -OCH3, and -OH substituents. Functional groups: **aldehyde, ether/methoxy, and phenolic hydroxyl**.
(b) A procaine-type structure: a benzene ring bearing -NH2, connected through a -COO- ester linkage to a diethylamino side chain. Functional groups: **primary aromatic amine and ester**, with a tertiary amine also present.
(c) An unsaturated nitro compound, e.g. CH3-CH=CH-CH2-NO2. Functional groups: **alkene (C=C) and nitro group**.
(a) Aldehyde, ether, phenolic -OH; (b) amine, ester; (c) C=C double bond, nitro group.

Q8.9: Comparing stability of two alkoxide ions

Which of the two: O2NCH2CH2O- or CH3CH2O- is expected to be more stable and why?
The nitro group is strongly electron-withdrawing through the σ framework (-I effect). In O2NCH2CH2O-, -NO2 pulls electron density away and disperses the negative charge on oxygen, lowering the anion's energy. In CH3CH2O-, the ethyl group is only weakly electron-donating (+I), which intensifies rather than disperses the charge.
O2NCH2CH2O- is more stable, because the -I effect of the nitro group disperses the negative charge on oxygen, whereas the ethyl group in CH3CH2O- has no such stabilising effect.

Q8.10: Why alkyl groups act as electron donors on a π system

Explain why alkyl groups act as electron donors when attached to a π system.
An alkyl group has no lone pair, yet it releases electron density into an adjacent π system through **hyperconjugation** (σ-π conjugation). A C-H σ bond on a carbon adjacent to a double bond (or carbocation) aligns with the adjacent p-orbital, allowing partial delocalisation of σ-electron density. More alkyl substitution means more available α-C-H bonds, hence greater stabilisation — this is why more substituted alkenes are more stable and tertiary carbocations are far more stable than primary ones.
Alkyl groups donate electron density to an adjoining π system through hyperconjugation (σC-H to π overlap), not through a lone pair.

Q8.11: Resonance structures of six species

Draw the resonance structures for the following compounds, showing electron shift with curved arrows: (a) C6H5OH (b) C6H5NO2 (c) CH3CH=CHCHO (d) C6H5-CHO (e) C6H5-CH2+ (f) CH3CH=CHCH2+.
(a) **Phenol:** oxygen's lone pair pushes into the ring, placing negative charge at ortho/para positions and making O formally positive — why phenol is more acidic than alcohols and substitutes at ortho/para.
(b) **Nitrobenzene:** the electron-poor -NO2 group pulls π electrons from the ring, leaving positive charge at ortho/para (deactivating, meta-directing).
(c) **Crotonaldehyde, CH3CH=CH-CHO:** conjugation gives positive charge on the β-carbon and negative charge on the carbonyl oxygen — why conjugated enals undergo 1,4-addition as well as 1,2-addition.
(d) **Benzaldehyde:** the ring donates into the carbonyl, giving positive charge at ortho/para and negative on the carbonyl oxygen.
(e) **Benzyl cation:** the empty p-orbital conjugates with the ring, delocalising positive charge onto ortho/para carbons — why benzylic cations form readily.
(f) **Crotyl cation:** classic allylic resonance, positive charge shared between C1 and C3.
In every case the resonance forms have the same atomic connectivity and only the position of electron pairs changes — this delocalisation lowers the energy relative to any single Lewis structure.

Q8.12: Electrophiles and nucleophiles

What are electrophiles and nucleophiles? Explain with examples.
An **electrophile** is any electron-deficient species that accepts an electron pair to form a new bond. Examples: H+, NO2+, carbocations, and Lewis acids like BF3, AlCl3.
A **nucleophile** is any electron-rich species that donates an electron pair. Examples: OH-, CN-, Cl-, and Lewis bases like NH3, H2O, ROH.
Electrophiles are electron-deficient, bond-accepting species (e.g. H+, BF3); nucleophiles are electron-rich, bond-donating species (e.g. OH-, NH3).

Q8.13: Classifying reagents as nucleophiles or electrophiles

Identify the bold reagents: (a) CH3COOH + **HO-** → CH3COO- + H2O (b) CH3COCH3 + **-CN** → (CH3)2C(CN)(OH) (c) C6H6 + **CH3C+O** → C6H5COCH3.
(a) HO- donates a lone pair → **nucleophile**.
(b) -CN attacks the electrophilic carbonyl carbon with a lone pair → **nucleophile**.
(c) CH3C+O is an acylium cation, electron-deficient, attacked by the ring → **electrophile**.
(a) Nucleophile, (b) Nucleophile, (c) Electrophile.

Q8.14: Classifying four organic reactions

Classify: (a) $CH_3CH_2Br + HS^- \rightarrow CH_3CH_2SH + Br^-$ (b) $(CH_3)_2C=CH_2 + HCl \rightarrow (CH_3)_2ClC-CH_3$ (c) $CH_3CH_2Br + HO^- \rightarrow CH_2=CH_2 + H_2O + Br^-$ (d) $(CH_3)_3C-CH_2OH + HBr \rightarrow (CH_3)_2CBrCH_2CH_3 + H_2O$.
(a) HS^- directly displaces Br^- → **nucleophilic substitution**.
(b) H^+ adds first, forming the more stable tertiary carbocation, captured by Cl^- (Markovnikov) → **electrophilic addition**.
(c) HO^- removes a β-hydrogen while Br^- leaves → **elimination**.
(d) The primary carbocation formed undergoes a 1,2-methyl shift to a tertiary carbocation before Br^- attacks → **rearrangement followed by nucleophilic substitution**.
(a) Nucleophilic substitution; (b) Electrophilic addition; (c) Elimination; (d) Rearrangement followed by nucleophilic substitution.

Q8.15: Relationship between three pairs of structures

What is the relationship between the members of the following pairs of structures — structural isomers, geometrical isomers, or resonance contributors?
(a) A pair like 1-chloropropane and 2-chloropropane illustrates **position (structural) isomerism**.
(b) A pair like cis-but-2-ene and trans-but-2-ene illustrates **geometrical (cis-trans) isomerism**.
(c) The two Lewis structures of the allyl anion illustrate **resonance**, not isomerism — only electron position differs, not atomic connectivity.
(a) Structural (position) isomers, (b) Geometrical isomers, (c) Resonance structures — the key test is whether atoms have moved (isomerism) or only electrons have moved (resonance).

Q8.16: Homolysis, heterolysis, and the resulting intermediates

Classify each bond cleavage as homolysis or heterolysis and identify the intermediate.
(a) **CH_3-CH_3 → $CH_3\bullet$ + $\bullet CH_3$**: symmetric split → **homolysis**, two **methyl free radicals**.
(b) **CH_3-Cl → CH_3^+ + Cl^-**: both electrons move to Cl → **heterolysis**, a **methyl carbocation**.
(c) **$(CH_3)_3C$-Br → $(CH_3)_3C^+$ + Br^-**: → **heterolysis**, a **tertiary carbocation** (hyperconjugation + I stabilised).
(d) **CH_3-MgBr → CH_3^- + $+MgBr$**: carbon is more electronegative, keeps both electrons → **heterolysis**, a **methyl carbanion** (why Grignards act as carbanion-equivalent nucleophiles).
(a) Homolysis → free radicals; (b) and (c) Heterolysis → carbocations; (d) Heterolysis → carbanion.

Q8.17: Inductive and electromeric effects explaining acid strength

Explain the terms Inductive and Electromeric effects. Which explains: (a) $Cl_3CCOOH > Cl_2CHCOOH > ClCH_2COOH$ (b) $CH_3CH_2COOH > (CH_3)_2CHCOOH > (CH_3)_3C.COOH$.
The **inductive effect** is a permanent, weak σ-bond electron displacement that weakens with distance. The **electromeric effect** is temporary, seen only with a multiple bond and only in the presence of an attacking reagent — a full π-electron pair shifts completely to one atom, disappearing once the reagent is removed.
(a) More Cl atoms withdraw more electron density by the **-I effect**, stabilising the carboxylate anion, so acidity rises with more Cl.
(b) More alkyl branching increases **+I** donation, destabilising the anion, so acidity falls with more branching.
Both orders are explained by the inductive effect: electron-withdrawing -I groups increase

acidity, electron-donating +I groups decrease it.

Q8.18: Principles of crystallisation, distillation, and chromatography

(a) **Crystallisation** relies on differential solubility at different temperatures: dissolve in minimum hot solvent, filter hot, cool slowly so pure compound crystallises while soluble impurities stay in the mother liquor. Example: purifying benzoic acid using hot water.
(b) **Distillation** uses differing boiling points: the liquid vaporises, is condensed in a Liebig condenser, and non-volatile impurity stays behind. Example: purifying water containing dissolved salts.
(c) **Chromatography** relies on differing rates of adsorption on a stationary phase as a mobile phase flows through. Example: column chromatography for plant pigments.
Crystallisation: differential solubility; Distillation: differential volatility; Chromatography: differential adsorption.

Q8.19: Separating two compounds with different solubilities

This is done by **fractional crystallisation**: dissolve both in hot minimum solvent S; on cooling, the less soluble compound crystallises first and is filtered off, while the mother liquor is concentrated further to recover the more soluble compound.
Fractional crystallisation exploits the difference in solubility at different temperatures to separate successive crops of crystals.

Q8.20: Distillation vs distillation under reduced pressure vs steam distillation

Simple distillation works for stable liquids with non-volatile impurities, heated to normal boiling point.
Vacuum distillation lowers the boiling point by lowering pressure, for liquids that decompose near their normal boiling point (e.g. glycerol).
Steam distillation uses Dalton's law of partial pressures for steam-volatile, water-immiscible liquids, distilling below both 373 K and the liquid's own boiling point (e.g. essential oils, aniline).
All three separate a volatile liquid from impurities, but differ in how the boiling condition is reached.

Q8.21: Chemistry of Lassaigne's test

Sodium metal is fused with the compound, converting covalent N, S, halogens into water-soluble sodium salts: NaCN (N alone), NaSCN (N+S together), NaX (halogens). The extract is tested: **for N**, boiled with $FeSO_4$, a trace of Fe^{3+} added, acidified — forms Prussian blue, $Fe_4[Fe(CN)_6]_3$. **For S**, sodium nitroprusside gives violet, or lead acetate gives black PbS. **For halogens**, acidified with HNO_3 then $AgNO_3$: white ppt soluble in NH_4OH = Cl, pale yellow partially soluble = Br, yellow insoluble = I.
Lassaigne's test converts covalently bound N, S, halogens into ionic sodium salts by fusion, then identifies them by characteristic precipitation/colour reactions.

Q8.22: Dumas method vs Kjeldahl's method for nitrogen estimation

In the **Dumas method**, the compound is heated with CuO in CO_2 atmosphere; C and H are oxidised to CO_2/H_2O, N is freed as N_2 gas, oxides of N reduced by hot Cu gauze; the gas mixture is passed through KOH (absorbs CO_2, H_2O) and N_2 volume is measured. Works for ALL nitrogen compounds.
In **Kjeldahl's method**, heating with conc. H_2SO_4 converts N to ammonium sulphate; heating with NaOH

liberates NH3, absorbed in standard acid, back-titrated. Faster, but fails for ring nitrogen (pyridine) or -NO2/-N=N- groups.
Dumas measures N2 gas directly and works universally; Kjeldahl converts N to NH3 and titrates, but fails for ring-nitrogen or nitro/azo compounds.

Q8.23: Principle of estimating halogens, sulphur, and phosphorus (Carius method)

All three use the **Carius method**: heated with fuming HNO3 (+AgNO3 for halogens) in a sealed Carius tube at 550-570 K. **Halogen** forms insoluble AgX, filtered/weighed. **Sulphur** oxidised to sulphate, precipitated as BaSO4 with BaCl2. **Phosphorus** oxidised to phosphate, precipitated as ammonium phosphomolybdate or Mg(NH4)PO4. Percentage calculated from precipitate mass, sample mass, and atomic-mass ratios.

Q8.24: Principle of paper chromatography

A partition technique: cellulose fibres hold stationary water; the mobile solvent rises by capillary action, and each component partitions between the two phases according to relative solubility, separating into spots. R_f = distance travelled by spot / distance travelled by solvent front.
Paper chromatography separates components based on differing partition between a stationary aqueous phase and a moving solvent phase.

Q8.25: Why nitric acid is added before silver nitrate for halogen testing

If N/S are also present, the extract contains NaCN and Na2S, which also react with AgNO3 (AgCN white, Ag2S black), masking the halide result. Boiling with dilute HNO3 first decomposes these into volatile HCN and H2S, leaving only halide to react cleanly.
Nitric acid decomposes interfering NaCN/Na2S into volatile gases, ensuring the AgX precipitate is due only to the halogen present.

Q8.26: Why sodium fusion is used to test nitrogen, sulphur, and halogens

N, S, and halogens are covalently bound in the compound and undetectable by ionic tests. Fusion with reactive sodium breaks these bonds and converts the elements into water-soluble ionic sodium salts, which can then be identified by standard tests.
Sodium fusion converts covalently bound N, S, halogens into water-soluble ionic salts detectable by standard ionic tests.

Q8.27: Separating calcium sulphate and camphor

Sublimation: camphor sublimes on gentle heating (solid directly to vapour), resolidifying on a cold surface, while non-subliming CaSO4 remains as residue.
Sublimation, because camphor sublimes on gentle heating while calcium sulphate remains behind as residue.

Q8.28: Why steam distillation vaporises a liquid below its boiling point

A liquid boils when its vapour pressure equals the surrounding pressure. In steam distillation, total pressure = vapour pressure of water + vapour pressure of the liquid (Dalton's law); since steam already contributes

substantial pressure, the mixture reaches the atmospheric total while the organic liquid's own partial pressure — and hence the temperature — is still below its normal boiling point.
Because total vapour pressure equals the sum of the individual pressures, boiling is reached at a lower temperature than the liquid alone would need.

Q8.29: Will CCl_4 give a white precipitate of AgCl with $AgNO_3$?

No. The C-Cl bonds in CCl_4 are purely covalent; CCl_4 never releases free Cl^- ions in solution, so $AgNO_3$ (which needs free Cl^-) cannot form a precipitate, even on heating.
No white precipitate forms, because CCl_4 is fully covalent and does not release Cl^- ions.

Q8.30: Why KOH is used to absorb CO_2 in carbon estimation

In Liebig's method, the compound is burnt over CuO, converting carbon quantitatively to CO_2, which is absorbed in pre-weighed KOH: $2KOH + CO_2 \rightarrow K_2CO_3 + H_2O$. KOH absorbs CO_2 rapidly and completely, so the mass gain gives the exact CO_2 (hence carbon) produced.
KOH quantitatively absorbs CO_2 as K_2CO_3, so the mass gain gives the exact carbon content.

Q8.31: Why acetic acid, not sulphuric acid, is used before the lead acetate test for sulphur

If H_2SO_4 were used, it would react with lead acetate to form a false white $PbSO_4$ precipitate, masking the true black PbS test for sulphur. Acetic acid acidifies without introducing sulphate ions.
Sulphuric acid gives a false white $PbSO_4$ that masks the true black PbS test; acetic acid avoids this interference.

Q8.32: Mass of CO_2 and H_2O from a compound of known % composition

An organic compound contains 69% carbon and 4.8% hydrogen, remainder oxygen. Calculate the masses of CO_2 and H_2O from complete combustion of 0.20 g.
Mass of C = 0.20 × 0.69 = 0.138 g. Moles C = 0.138/12 = 0.0115 mol = moles CO_2. Mass CO_2 = 0.0115 × 44 = **0.506 g**.
Mass of H = 0.20 × 0.048 = 0.0096 g. Moles H atoms = 0.0096, moles H_2O = 0.0096/2 = 0.0048 mol. Mass H_2O = 0.0048 × 18 = **0.0864 g**.
Mass of CO_2 produced = 0.506 g; mass of H_2O produced = 0.0864 g.

Q8.33: Kjeldahl's method — percentage of nitrogen

0.50 g of an organic compound, Kjeldahl's method: NH_3 absorbed in 50 mL of 0.5 M H_2SO_4; residual acid needed 60 mL of 0.5 M NaOH.
Total meq H_2SO_4 = 50 × 0.5 × 2 = 50 meq. Meq NaOH used = 60 × 0.5 = 30 meq. Meq acid reacted with NH_3 = 50 − 30 = 20 meq = 20 mmol N.
%N = (1.4 × 20)/0.50 = 28/0.50 = **56%**.
Percentage of nitrogen = 56%.

Q8.34: Carius method — percentage of chlorine

0.3780 g of an organic chloro compound gave 0.5740 g AgCl.

Molar mass AgCl = 143.5. Mass Cl = 0.5740 × (35.5/143.5) = 0.1420 g. %Cl = (0.1420/0.3780) × 100 = **37.57%**.
Percentage of chlorine ≈ 37.6%.

Q8.35: Carius method — percentage of sulphur

0.468 g of an organic sulphur compound gave 0.668 g $BaSO_4$.
Molar mass $BaSO_4$ = 233. Mass S = 0.668 × (32/233) = 0.09174 g. %S = (0.09174/0.468) × 100 = **19.60%**.
Percentage of sulphur ≈ 19.6%.

Q8.36: Hybridisation of the C2-C3 bond in a diene-yne

In $CH_2{=}CH{-}CH_2{-}CH_2{-}C{\equiv}CH$, which hybridised orbitals form the C2-C3 bond: (a) sp-sp2 (b) sp-sp3 (c) sp2-sp3 (d) sp3-sp3.
C1,C2 (C=C) are sp2; C3,C4 (single bonds) are sp3; C5,C6 (C≡C) are sp. C2-C3 joins an sp2 carbon to an sp3 carbon.
(c) sp2-sp3.

Q8.37: Chemical identity of Prussian blue in Lassaigne's test

(a) $Na_4[Fe(CN)_6]$ (b) $Fe_4[Fe(CN)_6]_3$ (c) $Fe_2[Fe(CN)_6]$ (d) $Fe_3[Fe(CN)_6]_4$.
NaCN first forms $Na_4[Fe(CN)_6]$ with Fe^{2+}; on acidifying with Fe^{3+} added, ferric ferrocyanide (Prussian blue) forms.
(b) $Fe_4[Fe(CN)_6]_3$ (ferric ferrocyanide, "Prussian blue").

Q8.38: Most stable carbocation

(a) $(CH_3)_3C{-}CH_2^+$ (b) $(CH_3)_3C^+$ (c) $CH_3CH_2CH_2^+$ (d) $CH_3{-}CH^+{-}CH_2CH_3$.
Stability order: tertiary > secondary > primary. (a) and (c) are primary; (d) is secondary; (b) is tertiary, with maximum hyperconjugative/inductive stabilisation.
(b) $(CH_3)_3C^+$ is the most stable, being a tertiary carbocation.

Q8.39: Best modern technique for isolating and purifying organic compounds

(a) Crystallisation (b) Distillation (c) Sublimation (d) Chromatography.
Unlike the other three (each limited to a specific compound category), chromatography is broadly applicable, highly sensitive, and versatile (column, paper, TLC, gas, HPLC variants), making it the most used modern technique.
(d) Chromatography.

Q8.40: Classifying the reaction of ethyl iodide with aqueous KOH

$CH_3CH_2I + KOH(aq) \rightarrow CH_3CH_2OH + KI$: (a) electrophilic substitution (b) nucleophilic substitution (c) elimination (d) addition.
OH^- (strong nucleophile) attacks the carbon bearing the leaving group I^-, displacing it directly in aqueous conditions.

(b) Nucleophilic substitution (SN2, since ethyl iodide is primary).

Class 11 Chemistry Chapter 8 – Notes and Extra Questions

Before attempting these exercise solutions, make sure your revision notes cover the IUPAC rules for selecting and numbering the parent chain, the difference between the inductive, resonance, electromeric, and hyperconjugative effects, and a clear comparison table of the qualitative tests (Lassaigne's test) versus the quantitative estimation methods (Dumas, Kjeldahl, Carius, and Liebig's method for carbon and hydrogen). For extra practice beyond the NCERT exercises, work through additional IUPAC naming problems on polyfunctional molecules, draw out full resonance structures with curved arrows for aniline, acetophenone, and the nitromethane anion, and practise two or three more Kjeldahl/Carius-style back-titration numericals, since this is one of the most frequently tested numerical formats in the CBSE board exam and in NEET/JEE Main.