

CLASS 10

SCIENCE

NCERT SOLUTIONS

NCERT Solutions for Class 10 Science Chapter 4: Carbon and its Compounds – Free PDF Download

Carbon and its Compounds is a concept-heavy organic chemistry chapter in the current 2026-27 CBSE Class 10 Science syllabus. Below are complete, verified solutions to the end-of-chapter exercise.

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Q1. Ethane, with the molecular formula C_2H_6 , has: (a) 6 covalent bonds (b) 7 covalent bonds (c) 8 covalent bonds (d) 9 covalent bonds

Each carbon has 4 bonds. There is 1 C–C bond and 6 C–H bonds (3 hydrogens per carbon $\times$ 2 carbons), totalling 7 covalent bonds.

Answer: (b).

Q2. Butanone is a four-carbon compound with the functional group: (a) carboxylic acid (b) aldehyde (c) ketone (d) alcohol

The suffix “-one” indicates a ketone functional group (C=O attached to two carbon chains).

Answer: (c).

Q3. While cooking, if the bottom of the vessel is getting blackened, it means that: (a) food is not cooked properly (b) fuel is not being fully burnt (c) fuel is wet (d) fuel is burning completely

Black soot forms from unburnt carbon, which is produced during incomplete combustion (insufficient air supply).

Answer: (b).

Q4. Explain the nature of the covalent bond using the bond formation in CH_3Cl .

Carbon has 4 valence electrons and needs 4 more to complete its octet; chlorine has 7 valence electrons and needs 1 more. In CH_3Cl , carbon shares one electron each with three hydrogen atoms and one electron with the chlorine atom, forming four single covalent bonds (shared electron pairs), completing the octets of C and Cl and the duplet of each H.

Q5. Draw the electron dot structures of (a) ethanoic acid (b) H_2S (c) propanone (d) F_2 .

(a) **Ethanoic acid (CH_3COOH):** a C–C single bond, three C–H single bonds on the first carbon, and on the second carbon a C=O double bond plus a C–O–H single bond, with the O and H each completing their octet/duplet.

(b) **H_2S :** sulphur shares one electron each with two hydrogen atoms (2 single bonds), with sulphur retaining two lone pairs.

(c) **Propanone (CH_3COCH_3):** the central carbon forms a C=O double bond with oxygen and single bonds to two CH_3 groups, each hydrogen sharing one electron with its carbon.

(d) **F_2 :** the two fluorine atoms share one electron pair (single bond), each retaining three lone pairs to complete its octet.

Q6. What is a homologous series? Explain with an example.

A homologous series is a group of organic compounds having the same general formula and similar chemical properties, where each successive member differs from the previous one by a $-CH_2-$ unit (14 u in mass).

Example: the alkane series – CH_4 (methane), C_2H_6 (ethane), C_3H_8 (propane), C_4H_{10} (butane) – general formula C_nH_{2n+2} .

Q7. How do ethanol and ethanoic acid differ from each other on the basis of their physical and chemical properties?

Physical: ethanol is a liquid with a mild alcoholic smell and neutral to litmus; ethanoic acid has a pungent, vinegar-like smell and turns blue litmus red (weak acid). Ethanoic acid also has a higher melting point

(freezes to a solid, “glacial acetic acid”, around 17°C).

Chemical: ethanoic acid reacts with metal carbonates/bicarbonates to release CO_2 and with bases to form salt+water (typical acid reactions); ethanol does not show these acidic reactions but reacts with sodium metal to liberate hydrogen gas, similar to ethanoic acid in that specific reaction.

Q8. Why does micelle formation take place when soap is added to water? Will a micelle be formed in other solvents such as ethanol also?

Soap molecules have a hydrophilic (water-loving) ionic “head” and a hydrophobic (water-repelling) long hydrocarbon “tail”. In water, the hydrocarbon tails cluster inward away from water while the ionic heads face outward into the water, forming a spherical micelle. In a non-polar/organic solvent like ethanol, this arrangement is not needed since the hydrocarbon tail is itself soluble in ethanol, so micelles do not form.

Q9. Why are carbon and its compounds used as fuels for most applications?

Carbon compounds like hydrocarbons undergo combustion releasing a large amount of heat energy (high calorific value), burn relatively cleanly (especially saturated hydrocarbons), are easily transported/stored (as liquids or gases), and are abundantly available (fossil fuels, biogas). This combination makes them practical, efficient fuels.

Q10. Explain the formation of scum when hard water is treated with soap.

Hard water contains calcium and magnesium salts. These react with the sodium/potassium salts in soap (which are water-soluble) to form insoluble calcium/magnesium salts of the fatty acids, which precipitate out as a sticky scum, wasting soap and reducing its cleaning efficiency.

Q11. What change would you observe if you test soap with litmus paper (red and blue)?

Soap solutions are mildly basic, so red litmus paper turns blue when dipped in soap solution, while blue litmus paper remains unchanged (stays blue).

Q12. What is hydrogenation? What is its industrial application?

Hydrogenation is the addition of hydrogen to an unsaturated hydrocarbon (containing a double or triple bond) in the presence of a catalyst (nickel), converting it into a saturated compound.

Industrial application: converting unsaturated vegetable oils into saturated fats (vanaspati ghee) by hydrogenation.

Q13. Which of the following hydrocarbons undergo addition reactions: C_2H_6 , C_3H_8 , C_3H_6 , C_4H_{10} ?

Addition reactions occur only in unsaturated hydrocarbons (those with a double or triple bond).

C_3H_6 is propene (C_3H_6 , one double bond, unsaturated) — this undergoes addition reactions. C_2H_6 (ethane), C_3H_8 (propane) and C_4H_{10} (butane) are saturated alkanes and do not undergo addition reactions.

Answer: C_3H_6 (propene).

Q14. Give a test that can be used to differentiate chemically between saturated and unsaturated hydrocarbons.

Add a few drops of bromine water to the hydrocarbon sample. An unsaturated hydrocarbon decolourises the orange-brown bromine water instantly (addition reaction across the double/triple bond). A saturated hydrocarbon does not decolourise bromine water under normal conditions.

Q15. Explain the mechanism of the cleaning action of soaps.

Soap molecules have a hydrophilic head (dissolves in water) and a hydrophobic tail (dissolves in oil/grease/dirt). The hydrocarbon tails surround and trap grease/dirt particles, forming a micelle with the dirt at the centre and ionic heads facing outward into the water. This keeps the dirt suspended (emulsified) in water rather than sticking to the cloth/surface, so it can be rinsed away.

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