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CLASS X · SCIENCE (086) · CHEMISTRY · CBSE BOARD EXAMINATION 2027

CHAPTER 4

# Carbon and its Compounds

Answer Booklet · CBSE marking-scheme answers with marks for every point

Every question of the chapter booklet | Marks shown point by point | MCQ keys with reasons

## INSIDE THIS BOOKLET


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## HOW TO USE THE ANSWERS

1. Answer the question in your notebook **first**. Open this booklet only to check.
2. Each answer is written the way the CBSE marking scheme sets it out: **value points**, with the **mark for each point** in orange beside it.
3. Give yourself marks point by point. Use the same **key words** in your own answers.
4. Equations must be balanced; diagrams must be labelled; numericals need formula, substitution and unit.
5. Copy every wrong answer to the My Mistakes page of your booklet.

READ THIS FIRST

# Marking Guide

Model answers to every question in the chapter booklet, set out the way a CBSE examiner marks them.

### HOW MARKS ARE GIVEN IN SCIENCE ANSWERS

1. **MCQ and assertion–reason (1 mark):** only the correct option scores. The reason given here is for your understanding.
2. **2 and 3 marks:** one mark (or ½) for each correct **value point**. The examiner looks for the key word – a long answer without it scores less than a short answer with it.
3. **Equations:** a correct balanced equation earns its full mark; an unbalanced one, or one with wrong formulae, usually earns ½ or nothing.
4. **Numericals:** formula, substitution and the final answer **with unit** are marked separately.
5. **Diagrams:** marks for a correct drawing and for the labels asked for. An unlabelled diagram earns little.
6. **Case study (4 marks):** 1 + 1 + 2. **Long answer (5 marks):** the split is shown beside each point.

PART A · ANSWERS

# A NCERT Practice – Answers

Marking-scheme answers for every question in Part A of the chapter booklet.

## Bonding in carbon

**A1.** Why does carbon form neither $C^{4+}$ nor $C^{4-}$ ions? How does it reach a stable configuration? **[3]**

Losing 4 electrons to form $C^{4+}$ needs a very large amount of energy. 1

Gaining 4 electrons to form $C^{4-}$ is difficult: a nucleus of 6 protons cannot hold 10 electrons. 1

So carbon shares its 4 valence electrons with other atoms, forming covalent bonds. 1

**A2.** Draw the electron dot structures of (i) fluorine, $F_2$ (ii) hydrogen sulphide, $H_2S$ (iii) carbon dioxide, $CO_2$. **[3]**

(i) $F_2$: one shared pair; each F keeps 3 lone pairs. 1



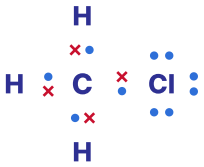

Fluorine, $F_2$ Hydrogen sulphide, $H_2S$ Carbon dioxide, $CO_2$

(ii) $H_2S$: S shares one pair with each H and keeps 2 lone pairs. 1

(iii) $CO_2$: C shares two pairs with each O (O=C=O); each O keeps 2 lone pairs. 1

**A3.** Explain the bonding in chloromethane, $CH_3Cl$, with its electron dot structure. [3]

Carbon shares one electron pair with each of three H atoms and one pair with Cl: 1




Chloromethane, $CH_3Cl$

All four are single covalent bonds. 1

Carbon now has 8 outer electrons, each H has 2 and Cl has 8. 1

**A4.** Why do covalent compounds have low melting and boiling points? Why are they poor conductors of electricity? [2]

The forces of attraction between their molecules are weak, so little energy separates them. 1

They have no ions (charged particles) to carry the current. 1

| Q | Answer | Working / reason |
|---|---|---|
| A5 | **(b)** 7 | 6 C–H bonds + 1 C–C bond. |

## Versatile nature of carbon

**A6.** Name the two properties of carbon that let it form a very large number of compounds. Explain each. [3]

Catenation: carbon atoms bond with other carbon atoms to form long chains, branched chains and rings. 1

Tetravalency: valency 4, so each carbon can bond with four other atoms – carbon, hydrogen, oxygen, nitrogen, chlorine and others. 1

Carbon is small, so these bonds are strong and the compounds are stable. 1

**A7.** What are isomers? Write the structures of all the isomers of pentane, $C_5H_{12}$. [3]

Isomers: compounds with the same molecular formula but different structures. 1

Straight chain: $CH_3-CH_2-CH_2-CH_2-CH_3$; one branch: $CH_3-CH(CH_3)-CH_2-CH_3$ 1

Two branches on one carbon: $C(CH_3)_4$ – three isomers in all. 1

**A8.** Write the molecular formula of cyclopentane. How many covalent bonds does a molecule have? [2]

$C_5H_{10}$ – a ring of 5 carbon atoms, each with 2 hydrogens. 1

5 C–C bonds + 10 C–H bonds = 15 single covalent bonds. 1

**A9.** What is a homologous series? Give three of its features, with the alcohols as an example. **[3]**

A series of compounds with the same functional group, each member differing from the next by $–CH_2–$. 1

Example: $CH_3OH$, $C_2H_5OH$, $C_3H_7OH$; successive members differ in mass by 14 u and share the formula $C_nH_{2n+1}OH$. 1

Similar chemical properties; physical properties (melting and boiling points) change gradually with mass. 1

**A10.** Which of these hydrocarbons take part in addition reactions: $C_2H_6$, $C_3H_8$, $C_3H_6$, $C_2H_2$, $CH_4$? Why? **[2]**

$C_3H_6$ (propene) and $C_2H_2$ (ethyne). 1

They are unsaturated – they have a double or triple bond that can add atoms. 1

## Functional groups and naming

**A11.** Write the condensed formulas of (i) ethanoic acid (ii) 1-bromopentane (iii) butanone (iv) hexanal. Can bromopentane have structural isomers? **[3]**

(i) $CH_3COOH$; (ii) $CH_3CH_2CH_2CH_2CH_2Br$ 1

(iii) $CH_3COCH_2CH_3$; (iv) $CH_3CH_2CH_2CH_2CH_2CHO$ 1

Yes – the Br can sit on the first, second or third carbon, and the chain can branch. 1

**A12.** Name these compounds: **(i)** $CH_3–CH_2–Br$ **(ii)** HCHO **(iii)** $H–C\equiv C–H$ **(iv)** $CH_3COCH_3$ **[2]**

(i) Bromoethane. ½

(ii) Methanal. ½

(iii) Ethyne. ½

(iv) Propanone. ½

**A13.** What is a functional group? Name the functional group in (i) propanal (ii) propanol (iii) propanone (iv) propanoic acid. **[3]**

An atom or group of atoms that decides the chemical properties of a carbon compound. 1

(i) Aldehyde, –CHO; (ii) alcohol, –OH. 1

(iii) Ketone, >C=O; (iv) carboxylic acid, –COOH. 1

## Chemical properties

**A14.** Why are carbon and its compounds used as fuels for most purposes? **[2]**

They burn in air to give a large amount of heat and light. 1

Many have a high calorific value, burn smoothly and are easy to store and carry (coal, LPG, petrol, CNG). 1

**A15.** While cooking, the bottom of a vessel turns black. What does this show, and what should be done? **[2]**

The fuel is not burning completely – the air holes of the burner are blocked. 1

Clean the air holes so that enough air mixes with the gas and it burns with a blue flame. 1

**A16.** Why is the change of ethanol into ethanoic acid called an oxidation reaction? Name two substances used for it. [2]

Oxygen is added to ethanol (and hydrogen removed), so it is oxidation. 1

Alkaline potassium permanganate (on heating) and acidified potassium dichromate. 1

**A17.** What is hydrogenation? Give its use in industry. Why are vegetable oils advised over animal fats? [3]

Addition of hydrogen to an unsaturated compound in the presence of a nickel or palladium catalyst. 1

Used to change vegetable oils into vanaspati ghee. 1

Vegetable oils are unsaturated and healthier; animal fats are saturated and harmful in large amounts. 1

**A18.** Ethyne mixed with oxygen is burnt for welding. Why is a mixture of ethyne and air not used? [2]

In pure oxygen ethyne burns completely and gives a very high temperature that melts metals. 1

In air it burns incompletely with a sooty flame and the temperature is not high enough. 1

## Ethanol and ethanoic acid

**A19.** How would you tell ethanol from ethanoic acid using (i) a physical property (ii) a chemical test? Write the equation. [3]

(i) Ethanoic acid smells of vinegar and turns blue litmus red; ethanol has a pleasant smell and no effect on litmus. 1

(ii) Add sodium hydrogencarbonate: ethanoic acid gives brisk fizzing of $CO_2$ (turns lime water milky); ethanol does not. 1

$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$ 1

**A20.** What is an ester? Describe how you would make one in the laboratory, with the equation. [3]

Warm 1 mL ethanol and 1 mL glacial ethanoic acid with a few drops of conc. sulphuric acid in a water bath for about 5 minutes; pour into water. 1

$CH_3COOH + C_2H_5OH \xrightarrow{\text{acid}} CH_3COOC_2H_5 + H_2O$ 1

An ester is a sweet-smelling compound formed from an acid and an alcohol (here ethyl ethanoate); used in perfumes and flavours. 1

**A21.** Write equations for: (i) sodium with ethanol (ii) ethanol heated with excess conc. sulphuric acid at 443 K. What is the role of the acid in (ii)? [3]

(i) $2\,Na + 2\,C_2H_5OH \longrightarrow 2\,C_2H_5ONa + H_2$ 1

(ii) $C_2H_5OH \xrightarrow{\text{hot conc. } H_2SO_4} CH_2{=}CH_2 + H_2O$ 1

The acid is a dehydrating agent – it removes water from ethanol. 1

## Soaps and detergents

**A22.** Explain how soap removes oily dirt from a cloth. [3]

A soap molecule has an ionic end that dissolves in water and a long hydrocarbon tail that dissolves in oil. 1

The tails attach to the oily dirt and the ionic ends face the water, forming a micelle with the dirt in its centre. 1

The micelles stay suspended in water; rinsing (helped by scrubbing) washes them and the dirt away. 1

**A23.** Why does a micelle form when soap is added to water? Will micelles form in ethanol? [2]

The hydrocarbon tails do not dissolve in water, so they cluster together inside, with the ionic ends outside facing water. 1

No – the tails dissolve in ethanol, so there is no need to cluster. 1

**A24.** Explain the formation of scum when soap is used with hard water. Why do detergents not form scum? [2]

Calcium and magnesium salts in hard water react with soap to form an insoluble precipitate (scum). 1

The calcium and magnesium compounds of detergents are soluble, so no scum forms. 1

**A25.** What is seen when soap solution is tested with red and blue litmus? Can a detergent be used to check whether water is hard? [2]

Red litmus turns blue (soap solution is basic); blue litmus stays blue. 1

No – a detergent lathers in both hard and soft water. 1

PART B · ANSWERS

# B Exemplar Practice – Answers

Marking-scheme answers for every question in Part B of the chapter booklet.

## Multiple choice

| Q | Answer | Working / reason |
|---|---|---|
| B1 | **(c)** $C_4H_8$ | $C_4H_8$ fits $C_nH_{2n}$ – it is an alkene. |
| B2 | **(b)** ethyne | $C_2H_2$ – there is no one-carbon alkyne. |
| B3 | **(b)** 14 u | $–CH_2–$ = 12 + 2 = 14 u. |
| B4 | **(b)** butane and isobutane | Both are $C_4H_{10}$ with different structures. |
| B5 | **(b)** –CHO | The ending -al means aldehyde. |
| B6 | **(a)** 5–8% ethanoic acid in water | A dilute solution of acetic acid. |
| B7 | **(b)** freezes in cold weather | Its melting point is 290 K. |
| B8 | **(b)** a dehydrating agent | It removes water, giving ethene. |
| B9 | **(c)** ethyne | Ethyne is unsaturated. |
| B10 | **(b)** sodium salts of sulphonic acids | They work even in hard water. |

## Short answer

**B11.** A compound X, $C_2H_4O_2$, turns blue litmus red and fizzes with sodium carbonate. Identify X and write its reaction with sodium carbonate. What forms when X is warmed with ethanol and a little conc. sulphuric acid? [3]

X is ethanoic acid, $CH_3COOH$. 1

$2\,CH_3COOH + Na_2CO_3 \longrightarrow 2\,CH_3COONa + H_2O + CO_2$ 1

A sweet-smelling ester, ethyl ethanoate ($CH_3COOC_2H_5$). 1

**B12.** Write the general formula of the alkenes. Name the third member and write its structure. [2]

$C_nH_{2n}$. 1

Butene, $C_4H_8$: $CH_2{=}CH{-}CH_2{-}CH_3$. 1

**B13.** Two compounds have the same formula $C_3H_6O$. One is an aldehyde and the other a ketone. Name and write both. What is this called? [3]

Propanal, $CH_3CH_2CHO$. 1

Propanone, $CH_3COCH_3$. 1

Isomerism – they are isomers (same formula, different structures). 1

**B14.** Saturated hydrocarbons burn with a blue flame but unsaturated ones give a sooty flame in air. Explain. Why are the air holes of a gas burner kept open? [2]

Saturated hydrocarbons burn completely; unsaturated ones (more carbon for each hydrogen) burn incompletely in air, leaving unburnt carbon as soot. 1

Open air holes let enough air mix with the gas so it burns completely, giving more heat and no soot. 1

**B15.** Give reasons: (a) ethanol is used in medicines like cough syrups and tincture of iodine; (b) industrial alcohol is mixed with methanol and a blue dye. [2]

(a) Ethanol is a good solvent – it dissolves many substances that do not dissolve in water. 1

(b) To make it unfit for drinking (denatured), and the colour shows it. 1

**B16.** Write the balanced equation for burning ethanol in air. Why is ethanol called a cleaner fuel? [2]

$C_2H_5OH + 3\,O_2 \longrightarrow 2\,CO_2 + 3\,H_2O$ + heat 1

It burns completely with a clean flame giving only $CO_2$ and water; it is made from sugarcane, a renewable source. 1

PART C · ANSWERS

# C Board Pattern Practice – Answers

Marking-scheme answers for every question in Part C of the chapter booklet.

## Covalent bonding

| Q | Answer | Working / reason |
|---|---|---|
| C1 | **(c)** 6 | Three pairs = 6 electrons. |
| C2 | **(a)** | Both true; R explains A. |
| C3 | **(b)** 4 | Two on each oxygen. |

**C4.** An element X has atomic number 6. (a) Write its electronic configuration and valency. (b) What type of bond does it form with chlorine? Give the formula. (c) Will this compound conduct electricity? Why? [3]

(a) 2, 4; valency 4. 1

(b) Covalent bond; $CCl_4$. 1

(c) No – it is a covalent compound with no ions. 1

## Catenation, isomers and homologous series

| Q | Answer | Working / reason |
|---|---|---|
| C5 | **(c)** $C_3H_4$ | Propyne, $C_nH_{2n-2}$. |
| C6 | **(b)** $C_3H_7OH$ | Add $–CH_2–$. |
| C7 | **(a)** | Both true; R explains A. |
| C8 | **(b)** 2 | Butane and isobutane. |

**C9.** Write the formula of the third member of the alkanes and the second member of the alkynes. Which of the two is saturated? [2]

Propane, $C_3H_8$. ½

Propyne, $C_3H_4$. ½

Propane is saturated (only single bonds). 1

**C10.** Draw the structures of the two isomers of butane and name them. Why do they have different properties? [3]

Butane: $CH_3-CH_2-CH_2-CH_3$ 1

Isobutane: $CH_3-CH(CH_3)-CH_3$ 1

Their atoms are arranged differently (straight vs branched chain), so their physical properties differ. 1

**C11.** Carbon and silicon both have valency 4. Why does carbon form so many more compounds? [2]

Carbon shows catenation strongly: the small atom forms strong C–C bonds, so long, stable chains and rings form. 1

Silicon forms chains of only 7–8 atoms, and these compounds are very reactive. 1

## Functional groups and naming

| Q | Answer | Working / reason |
|---|---|---|
| C12 | **(b)** propanal | -al means aldehyde. |
| C13 | **(b)** propanol | 3 carbons + –OH. |
| C14 | **(b)** $CH_3COCH_3$ | C=O between two carbons. |

**C15.** Name each compound and its functional group: **(i)** $CH_3COOH$ **(ii)** $CH_3CH_2Cl$ **(iii)** $CH_3CH_2CH_2CHO$ **(iv)** $CH_3CH{=}CH_2$ [2]

(a) Ethanoic acid – carboxylic acid. ½

(b) Chloroethane – halo (chloro). ½

(c) Butanal – aldehyde. ½

(d) Propene – alkene (double bond). ½

**C16.** State the steps used to name a carbon compound with a functional group. Name $CH_3CH_2CH_2COOH$ and $CH_3CH_2CH_2CH_2OH$. [3]

Count the carbons to get the stem (meth, eth, prop, but…); show the group as a prefix or suffix. 1

Drop the final ‘e’ of the alkane name when the suffix starts with a vowel. 1

Butanoic acid; butanol. 1

## Combustion, oxidation, addition and substitution

| Q | Answer | Working / reason |
|---|---|---|
| C17 | **(b)** hydrogenation | Addition of hydrogen, Ni catalyst. |

| | | |
|---|---|---|
| C18 | **(b)** substitution | Cl takes the place of H. |
| C19 | **(a)** | Both true; R explains A. |
| C20 | **(c)** | $KMnO_4$ adds oxygen – R is false. |

**C21.** Write equations for (a) the complete combustion of methane (b) the addition of hydrogen to ethene. Name the catalyst used in (b). [3]

(a) $CH_4 + 2\,O_2 \longrightarrow CO_2 + 2\,H_2O$ + heat and light — 1

(b) $CH_2{=}CH_2 + H_2 \xrightarrow{Ni} CH_3{-}CH_3$ — 1

Nickel (or palladium). — 1

**C22.** Alkaline potassium permanganate is added drop by drop to warm ethanol. At first its purple colour disappears; later the colour stays. Explain, with the reaction. [3]

$CH_3CH_2OH \xrightarrow{\text{alkaline } KMnO_4 + \text{heat}} CH_3COOH$ — 1

At first $KMnO_4$ is used up in oxidising ethanol, so its colour disappears. — 1

Once all the ethanol is oxidised, extra $KMnO_4$ is not used, so the purple colour stays. — 1

**C23.** Why do coal and charcoal only glow when burnt, while LPG and wax burn with a flame? [2]

A flame is produced only when gases burn. — 1

LPG is a gas and wax vaporises on heating; coal and charcoal are solids that do not vaporise. — 1

## Ethanol and ethanoic acid

| Q | Answer | Working / reason |
|---|---|---|
| C24 | **(b)** hydrogen | Sodium ethoxide also forms. |
| C25 | **(b)** ethyl ethanoate | Alcohol part ethyl + acid part ethanoate. |
| C26 | **(a)** | Both true; R explains A. |

**C27.** Write the reaction of ethyl ethanoate with sodium hydroxide. What is this reaction called, and how is it linked to making soap? [2]

$CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COONa + C_2H_5OH$ — 1

Saponification – soap is made by heating fats or oils (esters) with sodium hydroxide. — 1

## Soaps and detergents

| Q | Answer | Working / reason |
|---|---|---|
| C28 | **(b)** the tails point toward the oil at the centre | Ionic ends face the water outside. |
| C29 | **(b)** calcium and magnesium | They form scum with soap. |

**C30.** Distinguish between soaps and detergents (three points). **[3]**

Soap: Na/K salt of a long-chain carboxylic acid; detergent: Na salt of a sulphonic acid or an ammonium salt. 1

Soap forms scum in hard water; a detergent works in hard water. 1

Ionic end of soap $–COO^-$; of a detergent $–SO_3^-$ (or $–N^+$). 1

**C31.** A student shakes soap solution with distilled water in one tube and with hard water in another. What does she see? Explain. **[2]**

Distilled water: plenty of foam. Hard water: little foam and a white curdy scum. 1

Calcium and magnesium ions in hard water react with soap to form insoluble scum, using up the soap. 1

## Long answer

**C32.** A compound A, $C_2H_6O$, is used in cough syrups. Heated with excess conc. sulphuric acid at 443 K it gives B. B adds hydrogen in the presence of nickel to give C. (a) Identify A, B and C. (b) Write the two equations. (c) Write the equation for burning C in air. **[5]**

(a) A – ethanol, $C_2H_5OH$; B – ethene, $C_2H_4$; C – ethane, $C_2H_6$. 1½

(b) $C_2H_5OH \xrightarrow{\text{hot conc} \cdot H_2SO_4} CH_2{=}CH_2 + H_2O$ 1

$CH_2{=}CH_2 + H_2 \xrightarrow{Ni} CH_3{-}CH_3$ 1

(c) $2\,C_2H_6 + 7\,O_2 \longrightarrow 4\,CO_2 + 6\,H_2O$ 1

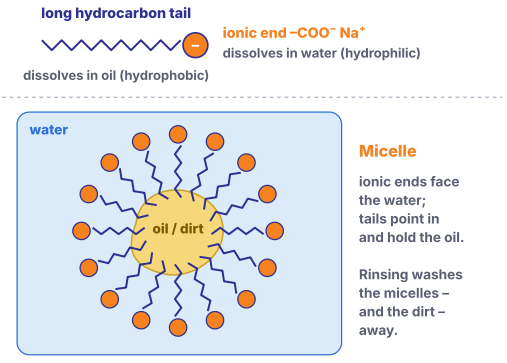
Conc. $H_2SO_4$ is the dehydrating agent; the hydrogenation is an addition reaction. ½

**C33.** (a) What is a soap? Explain its cleaning action with a labelled diagram of a micelle. (b) Why is soap not suitable for washing in hard water? **[5]**

(a) A sodium or potassium salt of a long-chain carboxylic acid. 1

It has an ionic (water-loving) end and a long hydrocarbon (oil-loving) tail. 1

Diagram: 1




The tails trap the oily dirt at the centre of the micelle; the ionic ends face water, so rinsing removes the dirt. 1

(b) Calcium and magnesium ions form insoluble scum with soap, wasting it. 1

**C34.** (a) Write the reactions of ethanoic acid with (i) sodium hydroxide (ii) sodium hydrogencarbonate (iii) ethanol. (b) How would you show that the gas in (ii) is carbon dioxide? **[5]**

(i) $NaOH + CH_3COOH \longrightarrow CH_3COONa + H_2O$ — 1

(ii) $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$ — 1

(iii) $CH_3COOH + C_2H_5OH \xrightarrow{\text{acid}} CH_3COOC_2H_5 + H_2O$ — 1

In (iii) a few drops of conc. $H_2SO_4$ act as catalyst; the ester (ethyl ethanoate) smells sweet. — 1

(b) Pass the gas through lime water – it turns milky. — 1

# D

PART D · ANSWERS

## Case-Based Questions – Answers

Marking-scheme answers for every question in Part D of the chapter booklet.

### D1. Case Study · The Kitchen Burner [4]

**(i)** Why did the flame turn yellow before the holes were cleaned? **[1]**

The air holes were blocked, so too little air reached the gas and it burnt incompletely. — 1

**(ii)** Write the molecular formula of butane. Is it saturated or unsaturated? **[1]**

$C_4H_{10}$; saturated (only single bonds; fits $C_nH_{2n+2}$). — 1

**(iii)** Write the balanced equation for the complete combustion of butane. **[2]**

Correct formulae: butane + oxygen → carbon dioxide + water (+ heat and light). — 1

Balanced: $2\,C_4H_{10} + 13\,O_2 \longrightarrow 8\,CO_2 + 10\,H_2O$ — 1

OR

**(iii)** Why do welders burn ethyne with oxygen and not with air? **[2]**

In oxygen, ethyne burns completely and produces a very high temperature that melts metals. — 1

In air it burns incompletely with a sooty flame and a lower temperature. — 1

### D2. Case Study · A Sweet Smell in the Lab [4]

**(i)** Name the sweet-smelling compound formed. **[1]**

Ethyl ethanoate (an ester). — 1

**(ii)** What is the role of the concentrated sulphuric acid? **[1]**

It acts as a catalyst (and takes up the water formed). — 1

**(iii)** Write the equation for the reaction. Name the reverse reaction with sodium hydroxide. **[2]**

$CH_3COOH + C_2H_5OH \xrightarrow{\text{acid}} CH_3COOC_2H_5 + H_2O$ — 1

Saponification. — 1

OR

**(iii)** How would you show which of the two starting liquids is the acid? Write the equation. **[2]**

Add sodium hydrogencarbonate to each: only ethanoic acid gives brisk fizzing of $CO_2$. 1

$CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$ 1

## D3. Case Study · Washing Day [4]

**(i)** Which ions make the well water hard? **[1]**

Calcium and magnesium ions ($Ca^{2+}$, $Mg^{2+}$). 1

**(ii)** Name the white deposit formed with soap. **[1]**

Scum – an insoluble calcium/magnesium compound of soap. 1

**(iii)** Why did the detergent work in the well water while soap did not? **[2]**

Soap reacts with $Ca^{2+}$ and $Mg^{2+}$ to form insoluble scum, so it is used up. 1

The charged ends of detergents do not form insoluble compounds with these ions, so they still clean. 1

OR

**(iii)** Why does soap solution look cloudy, and why do the micelles not settle down? **[2]**

Micelles are large enough to scatter light, so the solution looks cloudy. 1

Their ionic surfaces repel one another, so they stay spread out and do not settle. 1