What Is Organic Chemistry? — Teacher Answer Key

Suggested answers. Accept scientifically accurate alternative wording and suitable examples.

A. Foundations

1. Organic chemistry is the study of carbon compounds, especially those with carbon–hydrogen frameworks and related derivatives.

2. Carbon occurs in many organic compounds, but simple carbon oxides, carbonates and some other carbon compounds are conventionally classified as inorganic.

3. Carbon is tetravalent and bonds strongly to itself and other elements, allowing chains, rings, single/double/triple bonds and many structures.

4. A covalent bond is a shared pair of electrons. Common partners include hydrogen, oxygen, nitrogen, sulfur and halogens.

B. Classification

Substance	Classification
Methane CH_4	Organic
Carbon dioxide CO_2	Inorganic
Ethanol C_2H_5OH	Organic
Sodium carbonate Na_2CO_3	Inorganic
Glucose $C_6H_{12}O_6$	Organic
Water H_2O	Inorganic
Calcium carbonate $CaCO_3$	Inorganic
Ethanoic acid CH_3COOH	Organic

5. Carbon dioxide is a simple carbon oxide and carbonates are salts containing the carbonate ion; conventionally both fall under inorganic chemistry.

C. Carbon structures

6. Four covalent bonds per carbon (counting a double bond as two shared pairs).

7. Ethane has a C–C single bond; ethene has a C=C double bond.

8. A chain connects carbons in an open sequence (branched or unbranched); a ring forms a closed loop.

Table: methane—4; ethane—single; ethene—double; propane—3.

D. Everyday examples

9. Food: glucose/starch; fuel: octane/ethanol; medicine: aspirin/paracetamol; clothing: polyester/nylon/cellulose.

10. Cells use glucose as a fuel in respiration and as a building block for larger carbohydrates.

11. Many plastics comprise long chains of carbon-based repeating units; examples include polyethylene and polypropylene.

12. Sugar (sucrose) and citric acid; water and CO_2 are conventionally inorganic.

E. Matching

A → 2; B → 4; C → 1; D → 3.

F. Application and reasoning

13. Incorrect: methane (CH_4) is organic, but carbon dioxide (CO_2) or calcium carbonate ($CaCO_3$) is inorganic by convention.

14. Organic chemistry focuses mainly on carbon-containing molecular compounds, especially carbon frameworks; elemental carbon allotropes are treated separately.

15. Chemists design polymer structures and additives to control flexibility, strength, safety, recyclability and barrier properties.

16. They design, synthesize and test candidate molecules, investigate structure–activity relationships and optimise production and purity.

17. Example: plastic packaging can persist and fragment into microplastics; reducing single-use products, reuse and sound waste management help.

18. B

19. C

20. A

21. C_4H_{10} (butane). Each successive member adds CH_2; general formula for saturated acyclic alkanes is C_nH_{2n+2}.

22. Organic describes a chemical classification, not origin or safety. Synthetic medicines can be beneficial, while natural organic toxins (e.g. nicotine) can be harmful.

Assessment notes

Key distinction: avoid teaching “all carbon-containing compounds are organic.” Students should understand that classifications have conventional exceptions. Carbon typically forms four bonds, including multiple bonds. Give credit for examples that are correctly identified and justified.