

Exercise walk-through

Elements of Life ■ 1.2

eXercise

You must be able to

- name the main elements in living matter (C, H, O, N, P, S)
- explain why **carbon** 碳 is central (four covalent bonds)
- link carbon's bonding to the diversity of biological molecules

Method — The elements of life

Living matter is built mostly from a few elements: **carbon, hydrogen, oxygen, nitrogen, phosphorus, and sulfur** (CHONPS). Trace elements (like iron) also matter.

Method — Why carbon is central

Carbon has four valence electrons, so it forms **four stable covalent bonds**. This lets it build long chains, branches, and rings — the skeletons of all biological molecules.

Method — Carbon's versatility

Because carbon can bond to itself and to many other elements, it produces an enormous variety of stable molecules — the basis of life's molecular diversity.

Method — A worked link

Fatty acids, sugars, amino acids, and nucleotides all have carbon backbones; their different arrangements (built on carbon's four bonds) give them different structures and functions.

Practice 2.1 ■ 2 marks

Name four of the main elements found in living matter.

Solution 2.1

Method: The elements of life

Worked steps

Any four of: carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur **B1** **B1** *for two, for four.*

Practice 2.2 ■ 1 mark

How many covalent bonds can carbon form?

Solution 2.2

Method: Why carbon is central

Worked steps

Four **B1**.

Practice 2.3 ■ 1 mark

Why can carbon build such varied molecules?

Solution 2.3

Method: Why carbon is central

Worked steps

It forms four stable covalent bonds and can bond to itself and many elements **B1**.

Exam-style 3.1 ■ 1 mark

Carbon is central to biological molecules because it can form

- A** one covalent bond
- B** two covalent bonds
- C** four covalent bonds
- D** ionic bonds only

Solution 3.1

Method: Why carbon is central

- A one covalent bond
- B two covalent bonds
- C four covalent bonds
- D ionic bonds only



Worked steps

C — four covalent bonds.

Exam-style 3.2 ■ 1 mark

A student examines the backbones of a fatty acid, a sugar, and an amino acid.

- (a) What element forms the backbone of all three?
- (b) Explain how carbon's bonding allows chains, branches, and rings.

Solution 3.2

Method: Why carbon is central

Worked steps

(a) Carbon **B1**. (b) Its four bonds let carbon atoms link into long chains, add side branches, and close into rings, giving many possible skeletons **M1 A1**.

Exam-style 3.3 ■ 2 marks

Explain why carbon's ability to form four bonds contributes to the diversity of life's molecules.

Solution 3.3

Worked steps

Four bonding sites allow a huge number of stable arrangements of atoms, so an enormous variety of different molecules (and functions) can be built **M1** **A1**.