AP BIOLOGY • EXERCISE SHEET

1.2 Elements of Life

Name: _____ Class: _____ Date: _____ **Total: 10 marks**

Objective

Build the skills to answer exam questions on the **elements of life** and the special role of carbon.

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

1 Worked examples

Study these first. Each one shows the method for a question type used later —follow the steps and you can do the Practice and Exam-style questions yourself.

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.

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.

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.

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.

2 Practice

Now apply the methods above.

2.1 Name four of the main elements found in living matter. [2]

2.2 How many covalent bonds can carbon form? [1]

2.3 Why can carbon build such varied molecules? [1]

3 Exam-style questions

3.1 Carbon is central to biological molecules because it can form [1]

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

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

(a) What element forms the backbone of all three? [1]

(b) Explain how carbon's bonding allows chains, branches, and rings. [2]

3.3 Explain why carbon's ability to form four bonds contributes to the diversity of life's molecules. [2]

4 Go further

You are now ready for the real exam questions on this subtopic:

- work through the **1.2 Elements of Life** lesson on the **Learn** page;
- read the **Elements of Life** section of the AP Biology handout on the **Know** page.

Solutions

2.1 Any four of: carbon, hydrogen, oxygen, nitrogen, phosphorus, sulfur.

2.2 Four.

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

3.1 C —four covalent bonds.

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

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