

7.12 Origins of Life on Earth

Name: _____ Class: _____ Date: _____

Total: 8 marks

KEY WORDS evolution 进化 • variation 变异

Objective

Build the skills to answer exam questions on the **origins of life on Earth**.

You must be able to:

- outline the main hypothesis (simple molecules → polymers → protocells)
- describe the evidence (Miller-Urey, RNA world)
- put the key steps in order

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 proposed sequence

A leading hypothesis for life's origin:

1. **Simple organic molecules** (amino acids, nucleotides) formed from inorganic ones on early Earth.
2. These joined into **polymers**.
3. Polymers became enclosed in membrane droplets (**protocells**).
4. Molecules that could **self-replicate** allowed heredity and evolution to begin.

■ Miller-Urey evidence

The **Miller-Urey experiment** showed that amino acids can form from simple gases and energy (simulating early Earth), supporting step 1.

■ The RNA world

RNA can both store information **and** act as a catalyst, so it may have been the first self-replicating molecule — the “**RNA world**” idea.

■ A worked ordering

Order: inorganic molecules → organic monomers → polymers → protocells → self-replicating systems → early cells.

2 Practice

Now apply the methods above.

2.1 What did the Miller-Urey experiment produce? [1]

2.2 Why is RNA proposed as the first self-replicating molecule? [1]

2.3 What is a protocell? [1]

3 Exam-style questions

3.1 The Miller-Urey experiment supported the idea that [1]

- **A** cells arose fully formed
 - **B** organic molecules can form from inorganic ones
 - **C** DNA came before RNA
 - **D** life came from space only
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3.2 Put these steps of life's origin in order: polymers, protocells, simple organic monomers, self-replicating molecules. [2]

3.3 Explain why the ability to self-replicate was a key step for evolution to begin. [2]

Solutions

2.1 Amino acids (organic molecules) from simple gases and energy.

2.2 RNA can both store information and act as a catalyst (enzyme).

2.3 A membrane-enclosed droplet containing molecules — a precursor to a cell.

3.1 B — organic molecules can form from inorganic ones.

3.2 Simple organic monomers → polymers → protocells → self-replicating molecules.

3.3 Self-replication allowed information to be copied and passed on (heredity); variation in the copies could then be selected, so evolution could begin.