

# Fossils

4.6.3.2 · Biology · revision notes

What fossils are, the three ways they form, why the fossil record is incomplete, and what fossils tell us about how life developed. Questions include 'describe how fossils form', 'explain why scientists cannot be certain how life began' and interpreting evolutionary trees.

## Key facts

- Fossil = the remains of an organism from millions of years ago, found in rock
- Traces: footprints, burrows, rootlet traces
- Record incomplete: early life was soft-bodied; geological activity destroyed traces
- Fossils show how much or how little organisms have changed
- Formed by: no decay (conditions for decay absent); replacement by minerals; preserved traces
- Decay needs warmth, moisture and oxygen; remove one and remains may be preserved
- So scientists cannot be certain how life began

## Notes

### How fossils form

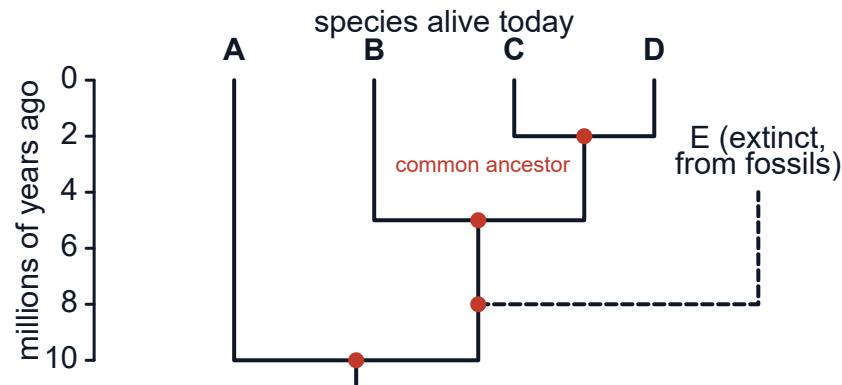
- **Fossils** are the 'remains' of organisms from millions of years ago, which are found in rocks.
- They may form from parts of organisms that **have not decayed**, because one or more of the **conditions needed for decay are absent**, e.g. too cold, too little oxygen or too little water. Examples: animals frozen in ice, or insects trapped in amber.
- They may form when parts of the organism are **replaced by minerals** as they decay. Hard parts such as bones, teeth and shells are often preserved this way.
- They may be **preserved traces** of organisms, such as **footprints, burrows** and **rootlet traces**.

### Why the fossil record is incomplete

- Many early forms of life were **soft-bodied**, so they have left few traces behind.
- What traces there were have been mainly destroyed by **geological activity** (for example rocks being worn away, folded or melted).
- This is why scientists **cannot be certain how life began on Earth**.
- Also, most dead organisms decay completely, so only a tiny fraction ever become fossils.

## What fossils tell us

- We can learn from fossils **how much or how little** different organisms have **changed** as life developed on Earth.
- Fossil data for extinct organisms is used with data from living organisms to build **evolutionary trees**.
- On an evolutionary tree, each branch point is a common ancestor. Organisms that share a more recent common ancestor are more closely related.



Evolutionary tree: the more recent the common ancestor, the more closely related the species.

## How to answer each type of question

### Describe how fossils form

2 to 3 marks

Grade 4

1. Give the three ways: no decay, replacement by minerals, preserved traces.
2. For 'no decay', say which condition was missing (e.g. oxygen).

**Example.** Describe three ways in which fossils can be formed. [3 marks]

**Model answer.** Parts of an organism do not decay because one or more of the conditions needed for decay are absent, e.g. no oxygen (1). Parts of the organism are replaced by minerals as they decay (1). Traces of the organism, such as footprints or burrows, are preserved (1).

### Explain why a specimen did not decay

2 marks

Grade 5

1. Name the missing condition: warmth, moisture or oxygen.
2. Link it to the decomposers: microorganisms could not grow or break down the tissue.

**Example.** A woolly mammoth was found frozen in ice. Its skin and hair were preserved. Explain why the mammoth had not decayed. [2 marks]

**Model answer.** The temperature was too low (1), so decomposers / microorganisms could not grow and break down the tissue (1).

## Don't lose marks

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- ✗ Saying fossils are only bones. Footprints, burrows and rootlet traces are fossils too.
- ✗ Saying the conditions for decay were 'bad'. Name the missing condition (oxygen, warmth or moisture).
- ✗ Saying early life left few fossils because it was 'too small'. The reason is that it was soft-bodied, and traces were destroyed by geological activity.

## More tips

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### Memory tricks

- Three ways to make a fossil: decay stopped, tissue swapped for minerals, trace stamped into rock (footprints).
- Decay needs warmth, moisture and oxygen; take one away and remains can last.
- Most recent common ancestor = most closely related.

### Exam technique

- In 'describe how fossils form', give three different methods, not three examples of the same method.
- For evolutionary trees, read branch points against the time axis and use the numbers in your answer.
- Link fossils to evidence for evolution: they show how organisms have changed over time.

## What each grade needs

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What you need to be able to do, from the first marks up to the top grade.

### Grade 3

#### Define a fossil

The remains of organisms from millions of years ago, which are found in rocks.

### Grade 4

#### Describe three ways fossils form

Parts that have not decayed, parts replaced by minerals, and preserved traces such as footprints.

### Grade 5

#### Explain why some remains do not decay

One or more of the conditions needed for decay (such as oxygen, warmth or moisture) are absent.

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