NAME _____ CLASS _____ DATE _____

IB BIOLOGY · A2.1

Origins of cells

Notes to fill in alongside the guide. Each numbered block matches a chapter of the guide, and of the lesson slides. Write in the gaps, answer the cues, annotate the figures, and sum up each section in your own words.

BY THE END YOU CAN

- [ ] Describe the conditions on early Earth and how they may have let carbon compounds form without life A2.1.1
- [ ] Distinguish living from non-living, and explain why viruses are usually counted as non-living A2.1.2
- [ ] Explain why the spontaneous origin of cells is hard to explain, and what had to arise first A2.1.3
- [ ] Evaluate the Miller-Urey experiment as evidence for the origin of carbon compounds A2.1.4
- [ ] Explain how fatty acids can form vesicles, and why a compartment was needed A2.1.5
- [ ] Explain why RNA is thought to have been the first genetic material A2.1.6
- [ ] Outline the evidence for a last universal common ancestor A2.1.7
- [ ] Outline how the dates of the first cells and of LUCA are estimated A2.1.8
- [ ] Outline the evidence that LUCA lived near hydrothermal vents A2.1.9

01 What counts as alive?

A2.1.2 HL A2.1.3 HL

CUES

Predict: Which feature of a virus is the strongest reason for calling it non-living?

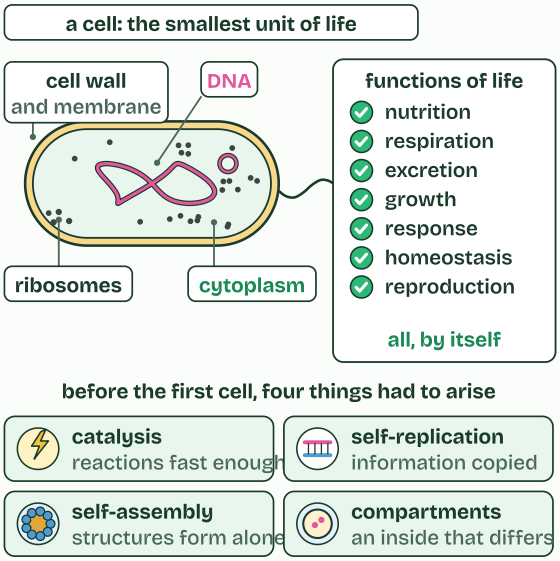
NOTES

1 Before the first cell, four things had to arise: _____, so that reactions could happen fast enough; _____ of molecules, so that information could be copied; _____ of structures such as membranes; and _____, so that the chemistry inside could differ from that outside.

Your own notes

ANNOTATE THE FIGURE

The figure shows it as A cell and A virus. Note what changes each time.



SPOT THE MISTAKE

What do students often get wrong about cells as the smallest units of self-sustaining life Challenge of explaining the spontaneous origin of cells? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 01 in two or three sentences of your own.

02 A world without oxygen

A2.1.1 HL

CUES

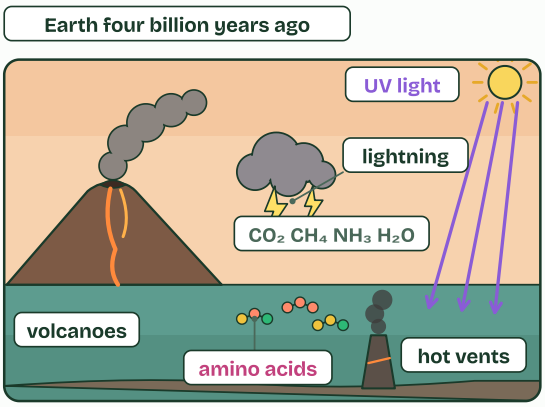
Predict: Why could amino acids build up in the early sea but not in today's?

NOTES

Your own notes

ANNOTATE THE FIGURE

The figure shows it as Four billion years ago and Today. Note what changes each time.



no oxygen
so no ozone layer

UV reaches the sea
energy to break bonds

more CO_2 and methane
a hotter planet

compounds build up
safe from O_2 and life

SPOT THE MISTAKE

What do students often get wrong about conditions on early Earth and the pre-biotic formation of carbon compounds? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 02 in two or three sentences of your own.

03 Lightning in a flask

A2.1.4 HL

CUES

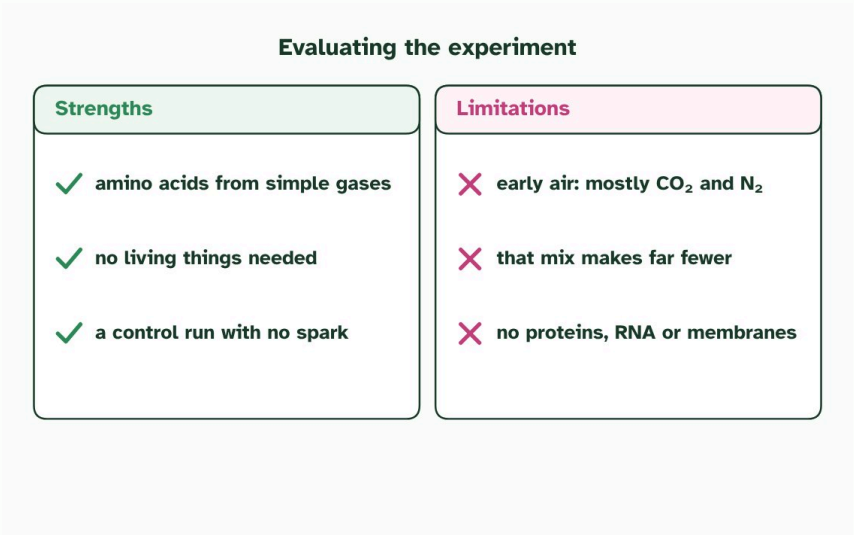
Predict: The experiment is repeated with nitrogen, carbon dioxide and water instead of methane, ammonia and hydrogen. What would you predict?

NOTES

Your own notes

ANNOTATE THE FIGURE

Annotate this still from the animation (The Miller-Urey experiment): what is happening, and why?



SUMMARY

Sum up section 03 in two or three sentences of your own.

04 The first bubbles

A2.1.5 HL

CUES

Predict: Why would a flat sheet of bilayer close up into a sphere?

What is meant by micelles?

What is meant by vesicle?

NOTES

1 In water they first gather into small balls, _____, with their tails hidden inside.

2 A flat sheet of bilayer leaves tails exposed at its edges, so it curls round and closes into a sphere: a _____.

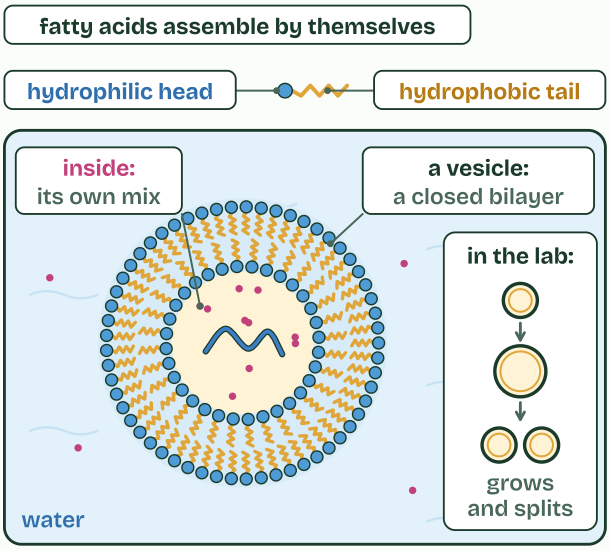
3 Fatty acids are amphipathic: _____, then bilayers.

4 A bilayer closes into a _____ so no tails are left exposed.

Your own notes

ANNOTATE THE FIGURE

Number the 4 steps on the figure and note what happens at each.



SPOT THE MISTAKE

What do students often get wrong about spontaneous formation of vesicles by coalescence of fatty acids into spherical bilayers? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 04 in two or three sentences of your own.

05 The RNA world

A2.1.6 HL

CUES

Predict: Why is the ribosome taken as evidence for the RNA world?

What is meant by ribozymes?

NOTES

1 RNA can also fold into shapes that catalyse reactions; such RNA catalysts are _____.

2 RNA can catalyse reactions: _____.

3 A strand of RNA: information in its _____.

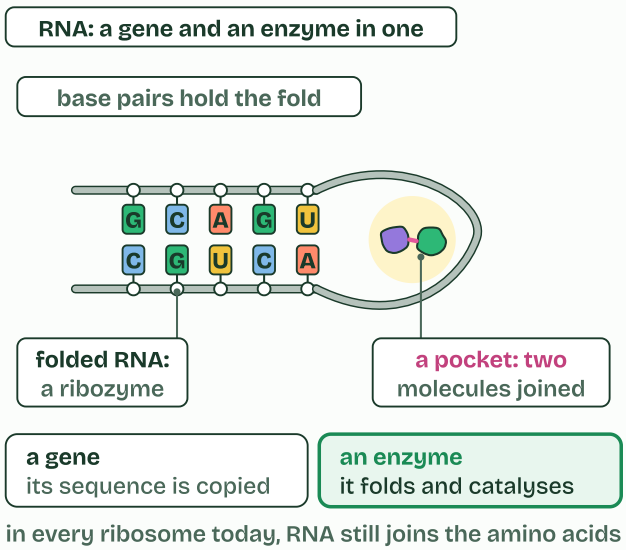
4 Free nucleotides pair with it to make a _____.

5 Folded on itself, RNA can _____ a reaction: a ribozyme.

Your own notes

ANNOTATE THE FIGURE

Number the 3 steps on the figure and note what happens at each: 1 sequence of bases; 2 complementary copy; 3 catalyse.



SPOT THE MISTAKE

What do students often get wrong about RNA as a presumed first genetic material? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 05 in two or three sentences of your own.

06 LUCA, the ancestor of everything

A2.1.7 HL A2.1.8 HL A2.1.9 HL

CUES

Predict: Which finding would most strongly challenge the idea of a single LUCA?

What is meant by last universal common ancestor?

NOTES

1 The simplest explanation is that all life descends from one population of cells, the _____ (LUCA).

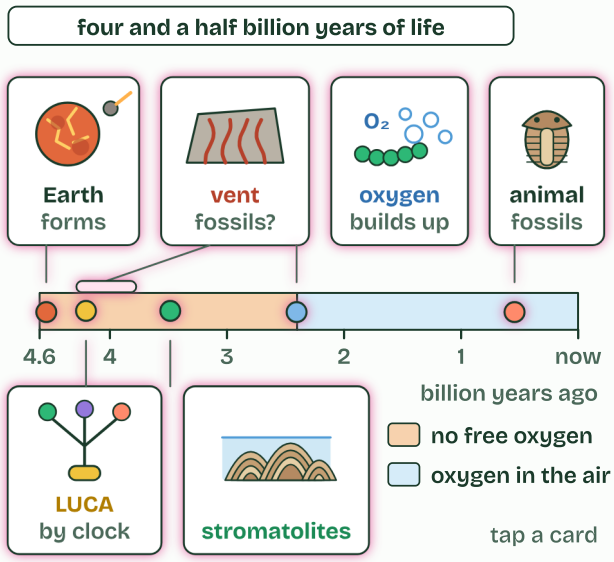
2 A _____ uses the differences between genes shared by all life, with a rate of change calibrated against dated fossils, to estimate when the lineages split; recent estimates put LUCA at around 4.2 billion years ago.

3 One genetic code and shared genes: _____.

Your own notes

ANNOTATE THE FIGURE

Label the key parts and add a note on what it shows.



SPOT THE MISTAKE

What do students often get wrong about evidence for a last universal common ancestor Approaches used to estimate dates of the first living cells and the last universal common ancestor Evidence for the evolution of the last universal common ancestor in the vicinity of hydrothermal vents? Write the mistake, then put it right.

The mistake

Put it right

SUMMARY

Sum up section 06 in two or three sentences of your own.

Check yourself

The check for this guide is online: a fresh paper of past-paper style questions from the exam bank on A2.1 each time, marked as you go, and saved to your Exam practice progress when you are signed in. Scan the code, or type the link.

biologybybradford.com/exam-maker/sit?topics=A2.1&level=HL&paper=quiz&marks=15&src=ep

How this was made. The course structure, the activities and the teaching choices come from my own classroom, my presentations and my years of teaching IB and AP Biology. I use Claude, an AI, to help write and build the interactive guides, lesson plans, slides and practice questions, and to draw the diagrams and code the interactives. I direct the work and review it against the IB and AP specifications before it goes live.