



# Impending Oxygen Crisis: Earth's Life at Risk

## Description

Presently, Earth thrives as a bastion of life, nourished by an atmosphere abundant in oxygen. However, historical geological evidence suggests that this is a transient condition—scientific projections indicate that, given the inexorable passage of time, our planet's atmosphere may once again become enriched in methane while dwindling in oxygen concentration.

Though this eventuality is projected to occur in approximately a billion years, analyses conducted in 2021 indicate that such a transformation is likely to transpire with alarming rapidity.

This atmospheric shift could revert Earth to a primordial state reminiscent of the conditions preceding the Great Oxidation Event (GOE), occurring roughly 2.4 billion years ago.

Environmental scientist Kazumi Ozaki of Toho University elucidates, "For many years, discussions regarding the lifespan of Earth's biosphere have been anchored in scientific insights concerning the Sun's gradual luminosity increase and the global carbonate-silicate geochemical cycle."

Ozaki further reflects, "A significant corollary of this theoretical framework posits a consistent decline in atmospheric CO<sub>2</sub> levels, concomitant with global warming over geological epochs."

The researchers assert that atmospheric oxygen likely does not constitute a permanent fixture of habitable worlds. This realization bears considerable implications for our endeavors to discern potential biosignatures of extraterrestrial life.

**Extreme Drop in Oxygen Will One Day Suffocate Most Life on Earth**  
Predicted evolution of atmospheric O<sub>2</sub> based on model simulations. (Ozaki and Reinhard, [Nature Geoscience](#), 2021)

The researchers posit that the deoxygenation of the atmosphere—wherein oxygen levels plummet to those analogous to the [Archaean eon](#)—will likely precede the onset of moist greenhouse conditions within Earth's climate system, as well as the extensive evaporation of surface water.

At that juncture, the extinction of humans and the vast majority of aerobic life forms will be inevitable, underscoring the urgency of our need to explore beyond our planetary confines.

**Extreme Drop in Oxygen Will One Day Suffocate Most Life on Earth**



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Dependence on oxygen among humans and other aerobic organisms. (Drazen\_/Canva)

To arrive at these conclusions, the research team meticulously simulated Earth's biosphere, incorporating variables such as solar luminosity and subsequent decreases in carbon dioxide levels resulting from escalating temperatures.

This reduction in carbon dioxide will diminish the proliferation of photosynthetic organisms, causing a subsequent decline in atmospheric oxygen.

While previous studies suggested that heightened solar radiation would lead to the evaporation of Earth's oceans within approximately two billion years, the current model, which amalgamated nearly 400,000 simulations, forecasts that oxygen depletion will precipitate mass extinctions long before such climate extremes manifest.

"The impending decrease in oxygen levels is extraordinarily drastic," asserts Chris Reinhard, an Earth scientist at the Georgia Institute of Technology. "We anticipate levels could plummet to around one-millionth of current concentrations."

This research holds profound relevance for contemporary astrobiological studies. As telescopes become increasingly advanced, discerning the myriad data collected will prove critical.

The researchers advocate for the exploration of alternative biosignatures beyond oxygen, positing that this approach may enhance our prospects for identifying extraterrestrial life. Their study contributes to NASA's NExSS (Nexus for Exoplanet System Science) initiative, which strives to unravel the complexities of planetary habitability beyond our own.

Calculations suggest that the epoch of an oxygen-rich Earth could span merely 20-30 percent of the planet's overall lifespan, with microbial organisms persevering long after more complex life forms have perished.

Ozaki poignantly remarks, "Following the impending great deoxygenation, the atmosphere will be characterized by elevated levels of methane, diminished CO<sub>2</sub>, and the absence of a protective ozone layer."

He foresees a world predominantly inhabited by anaerobic life forms.



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This significant research was published in [Nature Geoscience](#).

*An earlier version of this article was first published in March 2021.*

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## Vocabulary List:

1. **Deoxygenation** /,di:ɒksɪdʒə'neɪʃən/ (noun): The process of removing oxygen from a substance or environment.
2. **Biosphere** /'baɪəʊsfɪə/ (noun): The regions of the surface and atmosphere of the Earth or another planet occupied by living organisms.
3. **Transpire** /træn'spaɪə/ (verb): To occur or happen especially in the context of events developing over time.
4. **Proliferation** /prə,lɪfə'reɪʃən/ (noun): Rapid increase in the number or amount of something.
5. **Corollary** /kə'rɒləri/ (noun): A natural consequence or result of something.
6. **Implications** /,ɪmplɪ'keɪʃənz/ (noun): The possible effects or results of an action or a decision.

## Comprehension Questions

### Multiple Choice

1. What does historical geological evidence suggest about Earth's atmosphere?  
Option: It will remain oxygen-rich indefinitely  
Option: It may become enriched in methane and decrease in oxygen concentration  
Option: It will transition to a nitrogen-dominated atmosphere  
Option: It will have increasing levels of carbon dioxide
2. When is the projected timeframe for the atmospheric shift on Earth?  
Option: 100 years  
Option: 500 million years  
Option: 1 billion years  
Option: 5 billion years
3. What consequences are expected as a result of deoxygenation of the atmosphere?  
Option: Increased levels of oxygen  
Option: Moist greenhouse conditions  
Option: Global cooling  
Option: Reduced greenhouse effect



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4. What factor will likely precede the evaporation of Earth's surface water?
- Option: Heightened carbon dioxide levels
  - Option: Decrease in methane concentration
  - Option: Extinction of anaerobic life forms
  - Option: Extinction of aerobic life forms
5. What do researchers advocate for in order to enhance the search for extraterrestrial life?
- Option: Exploration of alternative biosignatures beyond oxygen
  - Option: Focusing solely on oxygen as a biosignature
  - Option: Halting space exploration
  - Option: Ignoring potential biosignatures
6. What is the anticipated outcome of the decrease in atmospheric oxygen levels according to Chris Reinhard?
- Option: Increased biodiversity
  - Option: Plummeting oxygen levels
  - Option: Carbon dioxide concentration
  - Option: Elevated ozone layer

### True-False

7. The atmosphere on Earth is expected to become methane-rich with a decrease in oxygen concentration.
8. Previous studies indicate that heightened solar radiation will lead to the evaporation of Earth's oceans within the next 500 years.
9. The impending decrease in oxygen levels is predicted to be gradual and insignificant.
10. The research team simulated nearly 400,000 scenarios in their Earth biosphere model.
11. The epoch of an oxygen-rich Earth is expected to last more than half of the planet's overall lifespan.
12. The study mentioned contributes to NASA's initiative to study exoplanets beyond our solar system.

### Gap-Fill



13. According to the content, the researchers project that Earth's atmosphere could shift in approximately \_\_\_\_\_ years.
14. The potential deoxygenation of the atmosphere could revert Earth to a state similar to conditions before the Great Oxidation Event approximately \_\_\_\_\_ years ago.
15. Chris Reinhard anticipates that oxygen levels could plummet to around one-\_\_\_\_\_ of current concentrations.
16. Ratan Naval Tata was the chairman of Tata Group from 1990 to \_\_\_\_\_.
17. The atmosphere following the impending great deoxygenation will be characterized by elevated levels of \_\_\_\_\_.
18. The study mentioned contributes to NASA's NExSS initiative, which aims to unravel the complexities of \_\_\_\_\_ habitability.

## Answer

**Multiple Choice:** 1. It may become enriched in methane and decrease in oxygen concentration 2. 1 billion years 3. Moist greenhouse conditions 4. Extinction of aerobic life forms 5. Exploration of alternative biosignatures beyond oxygen 6. Plummeting oxygen levels

**True-False:** 7. True 8. False 9. False 10. True 11. False 12. True

**Gap-Fill:** 13. 1 billion 14. 2.4 billion 15. millionth 16. 2012 17. methane 18. planetary

## Vocabulary quizzes

**Multiple Choice ( Select the Correct answer for each question. )**

1. Which process involves the removal of oxygen from a substance?



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- Option: Photosynthesis  
Option: Deoxygenation  
Option: Respiration  
Option: Transpiration
2. What term refers to the possible effects or consequences of an action or decision?  
Option: Proliferation  
Option: Corollary  
Option: Implications  
Option: Susceptibility
3. Which condition is characterized by high levels of cholesterol in the blood?  
Option: Xanthelasma  
Option: Adherence  
Option: Hypercholesterolemia  
Option: Augmenting
4. What term refers to the mental processes of acquiring knowledge and understanding?  
Option: Symbiotic  
Option: Cognition  
Option: Formidable  
Option: Elucidates
5. What word describes a prescribed course of medical treatment diet or exercise?  
Option: Intricate  
Option: Regimen  
Option: Meticulously  
Option: Artifacts
6. What term describes differences or inequalities especially in treatment or opportunities?  
Option: Perplexing  
Option: Disparities  
Option: Tantalizing  
Option: Anomalous
7. What process involves making small changes to improve or correct the functioning of something?  
Option: Recalibrating  
Option: Susceptibility  
Option: Correlations  
Option: Perplexing
8. Which term describes the quality of being bright or giving off light?  
Option: Luminosity



- Option: Disparities
- Option: Tantalizing
- Option: Anomalous

9. What term means to draw out a response answer or information from someone?

- Option: Regimen
- Option: Elicited
- Option: Hypercholesterolemia
- Option: Adherence

10. Which word describes something with many complex interrelated parts or details?

- Option: Intricate
- Option: Meticulously
- Option: Artifacts
- Option: Cognition

**Gap-Fill ( Fill in the blanks with the correct word from the vocabulary list. )**

11. The biosphere is the global sum of all ecosystems and forms the \_\_\_\_\_ where life exists.

12. The company is considering \_\_\_\_\_ its production capacity to meet increasing demand.

13. The team faced a \_\_\_\_\_ opponent in the final match but they emerged victorious.

14. The discovery of new evidence led to a shift in the \_\_\_\_\_ of scientific thought on the subject.

15. The study aimed to analyze the \_\_\_\_\_ between students' academic performance and their extracurricular activities.

16. In a \_\_\_\_\_ relationship both organisms benefit from the association.

17. The company is considering \_\_\_\_\_ its production capacity to meet increasing



demand.

18. Successful treatment outcomes often depend on patients' \_\_\_\_\_ to the prescribed medication regimen.

19. The artist \_\_\_\_\_ planned every stroke and detail of the painting to achieve perfection.

20. Archaeologists uncovered ancient \_\_\_\_\_ that shed light on the civilization's daily life.

**Matching Sentences ( Match each definition to the correct word from the vocabulary list. )**

21. The rapid of social media platforms has changed the way people communicate globally.
22. Certain individuals may have a genetic to developing allergies.
23. The results of the experiment were considered because they did not align with previous findings.
24. The movie trailer offered a glimpse of the plot leaving viewers eager to see more.
25. The research study found strong between stress levels and cardiovascular health.
26. The professor's explanation the complex concept for the students.
27. There are significant economic between urban and rural communities in terms of access to resources.
28. The scientist found the results of the study to be and in need of further investigation.
29. The decision to cut funding for the program has wide-ranging for the local community.
30. The team is considering their lineup with experienced players for the upcoming season.

## Answer

**Multiple Choice:** 1. Deoxygenation 2. Implications 3. Hypercholesterolemia 4. Cognition 5. Regimen 6. Disparities 7. Recalibrating 8. Luminosity 9. Elicited 10. Intricate

**Gap-Fill:** 11. layer 12. augmenting 13. formidable 14. paradigm 15. correlations 16. symbiotic 17. augmenting 18. adherence 19. meticulously 20. artifacts

**Matching sentence:** 1. proliferation 2. susceptibility 3. anomalous 4. tantalizing 5. correlations 6. elucidates 7. disparities





8. perplexing 9. implications 10. augmenting

**CATEGORY**

1. Health - LEVEL6

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