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# Life on Earth May Have Originated from Frozen Toxin

## Description

Researchers have revealed that a toxic chemical, hydrogen cyanide, might have played a crucial role in the emergence of life on Earth. According to a study published in *ACS Central Science*, this chemical can freeze into solid crystals, which are highly reactive at low temperatures. This unique reactivity could enable chemical reactions that typically do not occur in such cold conditions, potentially resulting in the formation of essential building blocks for life.

Martin Rahm, the lead researcher, explained that while the exact origins of life remain unclear, understanding how its ingredients form is becoming more accessible. He highlighted hydrogen cyanide as a plausible contributor to this chemical complexity, noting its surprisingly rapid reactivity in cold environments.

In space, hydrogen cyanide has been found on comets and in the atmospheres of celestial bodies like Saturn's moon, Titan. When it comes into contact with water, it can create polymers, amino acids, and nucleobases, which are vital components of proteins and DNA. To explore how hydrogen cyanide acts when frozen, the research team employed computer simulations to investigate its crystalline structure.

The simulations depicted a cylindrical crystal, about 450 nanometers long, resembling gemstones. This form aligns with previous observations of crystal formations known as "cobwebs," which emerge from a central point.

Crucially, the study indicates that these frozen crystals can facilitate rare chemical reactions, potentially transforming hydrogen cyanide into hydrogen isocyanide, a more reactive variant. This transformation can occur rapidly or over several days, implying that more complex prebiotic compounds may also develop.

Looking ahead, the researchers hope to validate their findings through laboratory tests, such as grinding hydrogen cyanide crystals in water to see if they promote the formation of complex molecules in extreme cold.



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## Vocabulary List:

1. **Cyanide** /'saɪə,naɪd/ (noun): A toxic chemical compound containing the cyano group typically associated with poisoning.
2. **Reactivity** /ri:'æk.tɪ.vɪ.ti/ (noun): The propensity of a substance to undergo chemical reaction.
3. **Polymers** /'pɒlɪməz/ (noun): Large molecules composed of repeating structural units important in various chemical processes.
4. **Amino Acids** /ə'mi:.nɒs 'æs.ɪdz/ (noun): Organic compounds that combine to form proteins essential for life.
5. **Crystalline** /'krɪs.tə.lɪn/ (adjective): Having the structure and form of a crystal; composed of crystals.
6. **Transformation** /,træns.fə'meɪ.ʃən/ (noun): A thorough or dramatic change in form or appearance.

## Comprehension Questions

### Multiple Choice

1. What toxic chemical is suggested to have played a crucial role in the emergence of life on Earth?  
Option: Hydrogen Peroxide  
Option: Hydrogen Cyanide  
Option: Chlorine  
Option: Sulfuric Acid
2. Where can hydrogen cyanide be found in space?  
Option: Mars  
Option: Venus  
Option: Comets  
Option: Jupiter
3. What are the potential products formed when hydrogen cyanide comes into contact with water?  
Option: Metals  
Option: Polymers, amino acids, nucleobases  
Option: Radioactive elements  
Option: Plastic
4. What transformation can hydrogen cyanide undergo, as mentioned in the study?  
Option: Into Oxygen



- Option: Into Nitrogen
- Option: Into Hydrogen Isocyanide
- Option: Into Carbon Dioxide

5. What is the proposed method to validate the findings in the study?

- Option: Laboratory tests with heat
- Option: Laboratory tests with pressure
- Option: Grinding hydrogen cyanide crystals in water
- Option: Field experiments in deserts

6. What is the size of the cylindrical crystal depicted in the simulations?

- Option: 100 nanometers
- Option: 250 nanometers
- Option: 450 nanometers
- Option: 700 nanometers

### True-False

- 7. The lead researcher mentioned that understanding the origins of life is becoming more difficult.
- 8. Hydrogen cyanide has only been found on Earth.
- 9. The study suggests that hydrogen cyanide can only transform into less reactive compounds.
- 10. The crystal formations in the simulations are compared to diamonds.
- 11. The study proposes conducting laboratory tests as the next step for validation.
- 12. The formation of prebiotic compounds may result from the transformations mentioned in the study.

### Gap-Fill



13. According to Martin Rahm, hydrogen cyanide can freeze into solid crystals that are highly reactive at low temperatures, potentially enabling the formation of essential building blocks for life. This unique reactivity occurs due to the chemical's ability to facilitate chemical reactions that typically do not occur in such \_\_\_\_\_ conditions.
14. When hydrogen cyanide comes into contact with water, it can create polymers, amino acids, and nucleobases - vital components of proteins and DNA. This process is significant in the potential formation of complex \_\_\_\_\_ compounds.
15. The study suggests that frozen crystals of hydrogen cyanide can facilitate rare chemical reactions, potentially transforming the chemical into hydrogen isocyanide, a more reactive variant that may lead to the development of more complex \_\_\_\_\_.
16. To validate their findings, the researchers aim to conduct laboratory tests involving grinding hydrogen cyanide crystals in \_\_\_\_\_ to observe the promotion of complex molecule formation in extreme cold.
17. The study depicts the frozen crystals of hydrogen cyanide as cylinders approximately \_\_\_\_\_ nanometers long, resembling gemstones.
18. The crystal formations exhibited in the simulations align with previous observations of crystal structures known as \_\_\_\_\_, which emerge from a central point.

## Answer

**Multiple Choice:** 1. Hydrogen Cyanide 2. Comets 3. Polymers, amino acids, nucleobases 4. Into Hydrogen Isocyanide 5. Grinding hydrogen cyanide crystals in water 6. 450 nanometers

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

**Gap-Fill:** 13. cold 14. prebiotic 15. compounds 16. water 17. 450 18. cobwebs



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## Vocabulary quizzes

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

1. What term refers to the presence of a harmful substance in the environment?  
Option: Infection  
Option: Contamination  
Option: Pollution  
Option: Sanitation
2. Which process is essential for maintaining air quality in a closed environment?  
Option: Isolation  
Option: Filtration  
Option: Ventilation  
Option: Contamination
3. What is the term for the spread of a disease or infection from one person to another?  
Option: Reception  
Option: Transmission  
Option: Conduction  
Option: Reflection
4. Which type of treatment aims to alleviate symptoms or cure a disease?  
Option: Preventative  
Option: Therapeutic  
Option: Diagnostic  
Option: Prophylactic
5. What process involves the progressive loss of structure or function in neurons?  
Option: Neuroinflammation  
Option: Neurogenesis  
Option: Neurodegeneration  
Option: Neuroplasticity
6. What process confirms that research findings are accurate and reliable?  
Option: Experimentation  
Option: Validation  
Option: Hypothesis  
Option: Observation
7. What term refers to tiny particles or droplets suspended in the air?



- Option: Solvent
- Option: Aerosol
- Option: Mist
- Option: Vapor

8. What term describes the rapid increase in numbers especially of cells or organisms?

- Option: Diminishing
- Option: Proliferating
- Option: Declining
- Option: Ceasing

9. What is the body's response to injury or infection called?

- Option: Hemostasis
- Option: Inflammation
- Option: Regeneration
- Option: Debridement

10. What process is used to separate solids from liquids or gases using a filter?

- Option: Circulation
- Option: Filtration
- Option: Evaporation
- Option: Distillation

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

11. The yoga retreat offered a sense of \_\_\_\_\_ to its participants.
12. \_\_\_\_\_ is a highly toxic chemical compound that can be fatal.
13. Many plastics are made from long chains of \_\_\_\_\_ .
14. Her \_\_\_\_\_ at the meeting was greatly appreciated by all attendees.
15. The message was so \_\_\_\_\_ that no one could decipher its meaning.
16. His \_\_\_\_\_ skills in math earned him a scholarship.
17. The \_\_\_\_\_ of hostilities was agreed upon by both parties.
18. The caterpillar's \_\_\_\_\_ into a butterfly is a remarkable process.



19. A \_\_\_\_\_ diet can lead to various health issues.

20. The library has a \_\_\_\_\_ of resources available for research.

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

21. The city was alive with people rushing to work showcasing a vibrant hustle.
22. He used modern technology for the detection of environmental pollutants.
23. The study of the metagenome helps researchers understand microbial diversity.
24. The scientist admired the beautiful crystalline structure under the microscope.
25. The reactivity of certain chemicals can lead to dangerous reactions.
26. The transmission of data over the internet has revolutionized communication.
27. Aerosol sprays can be harmful if inhaled in large amounts.
28. The validation of the study's results is crucial for scientific integrity.
29. The disease was especially prevalent in rural areas.
30. Humans have an innate need for companionship throughout their lives.

**Answer**

**Multiple Choice:** 1. Contamination 2. Ventilation 3. Transmission 4. Therapeutic 5. Neurodegeneration  
6. Validation 7. Aerosol 8. Proliferating 9. Inflammation 10. Filtration

**Gap-Fill:** 11. serenity 12. Cyanide 13. polymers 14. presence 15. cryptic 16. exceptional 17. cessation  
18. transformation 19. nutrient-deficient 20. plethora

**Matching sentence:** 1. hustle 2. detection 3. metagenome 4. crystalline 5. reactivity 6. transmission 7. aerosol  
8. validation 9. prevalent 10. companionship

**CATEGORY**

- 1. Health - LEVEL5

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- 1. ESL learning



2. esl news
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