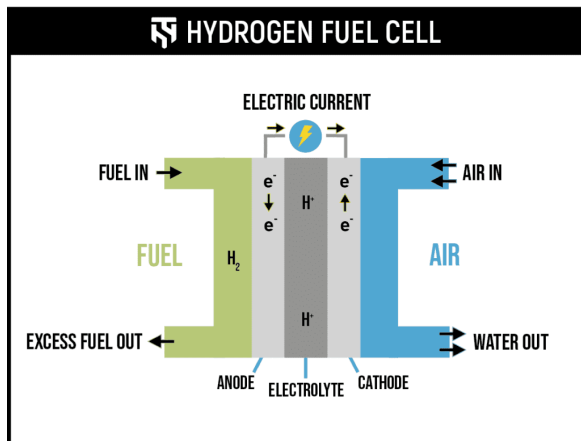


BLACK 21. Dream Technology

: Hydrogen fuel cells 수소 연료 전지

[1문단]



(A) Humanity has always dreamed of a future which we could live without polluting the Earth, without consuming nature to sustain our lives, and in harmony with the deeper rhythms of the universe.

(B) Among the innovations led us forward, hydrogen fuel cells stand out — not merely as an energy source, but as a profound symbol of a new relationship between humanity and nature. In every

sense, this is a dream technology.

(C) This dream was once thought to be an imagination that could only be possible in myths and sci-fi, but today, advances in science and technology are gradually breaking down those boundaries.

[2문단]

Hydrogen fuel cells are devices that generate electrical energy through the combination of H₂ and Oxygen(O₂). This process is based on **[combustion/electrochemical reactions]**, not **[combustion/electrochemical reactions]**. It does not involve sparks or smoke, and operates quietly and cleanly. There is only one result, pure Water(H₂O). The basic structure consists of. **Inside the fuel cell [is/are] ‘Anode’ and ‘Cathode’, and ‘Electrolyte’ connecting them.** Hydrogen is injected into the ‘anode’, where it is separated into ‘proton (H⁺)’ and ‘electron (e⁻)’. ‘Protons’ pass through ‘electrolyte membrane’ and move to ‘cathode’, and ‘electrons’ flow along an external circuit to generate electrical energy. **At ‘cathode’, ‘proton’, ‘electron’, and oxygen introduced from the outside [meets/meet] again to form water, [completing/ceasing] the entire reaction.**

***Hydrogen (H₂) + Oxygen (O₂) → Electricity + H₂O + W₂O (H₂O)**

There are no pollutants; only water remains: A **[clean/stain]**, silent, and elegant process — with no _____, no carbon, and no noise. This mechanism is not only efficient, but beautiful in its **[simplicity/complexity]**. It mirrors the grand processes of the cosmos — a small, controlled echo of the fusion that powers stars.

[3문단]

First of all, this technology has a strong **[environmental/monetary]** significance. It emits no carbon dioxide, fine dust, or toxic gases. It is a practical technical solution to reduce greenhouse gases that cause global warming and **[excel/curb]**억제[제한]하다 the climate crisis. ① Hydrogen fuel cells **[outperform/are outperformed by]** internal combustion engines in terms of efficiency. ② Since electricity is directly generated and used, energy loss is low, and even the generated heat may be used **[to/for]** hot water or heating. ③ This technology can be applied to a variety of fields. ④ Hyundai Motor's **Nexo** and Toyota's **Mirai** are on the road, and in Germany, a hydrogen train called **Coradia iLint** is in operation. ⑤ **Enepam**, a home hydrogen fuel cell system, **[were used/has been used]** by NASA as a **[mean/means]** of supplying energy in space since the Apollo spacecraft. ⑥ Hydrogen is a very flexible and **[apprehensive/comprehensive]**포괄적인 energy source that can be extended beyond Earth to space. ⑦ From urban life to interstellar exploration, hydrogen proves remarkably **[adaptable/sustainable]**.

[4문단]

[Thanks to/Despite] its promise, hydrogen technology still faces major challenges. First of all, **the cost of producing hydrogen is high, and green hydrogen, which is made by decomposing water by solar or wind power, is still not economical.** Storage and ①transportation technology are also difficult because hydrogen is the lightest element and a substance that poses a risk of ②exploration. The infrastructure for hydrogen vehicles, such as charging stations, is still **insufficient**. **[Furthermore/Nonetheless]**, hydrogen technology is relatively ③slow to supply in the face of the recent competition with the rapidly growing electric vehicle industry.

[Furthermore/Nonetheless], hydrogen fuel cells are more than just technology. **It is a symbol that embodies the philosophy and worldview of mankind, and a ④practical language that shows how technology can communicate with nature.** Hydrogen is an element that makes up 90% of the universe, and it is the fuel of stars and the origin of life. Perhaps **the most harmonious way that nature allows us to use energy is that humans directly handle hydrogen to generate electricity and use it as a ⑤byproduct to generate water again.**

[5문단]

Hydrogen fuel cells are not yet a complete technology. However, their potential and philosophy are quite complete. **Moving from a carbon-centered civilization to a hydrogen-centered civilization**

is a(an) _____ choice beyond just an environmental choice and a responsible decision for future generations. Technology is not an end in itself. True technology is the power to realize human dreams and lead the world in a better direction through them. In that sense, hydrogen fuel cell is one of the most beautiful technologies our time can embrace. ⇨ 어순배열 : { with nature / (collide) / without / in harmony / the way / us / to live together / opens }. The purest fuel from space, the technology that connects Earth's breath again — the hydrogen fuel cell.

주요어휘 영영풀이

- 1) _____ : ㉠ a substance that makes land, water, and air dirty and not safe to use
- 2) _____ : ㉡ to force a liquid medicine or drug into someone or something by using a special needle
- 3) _____ : ㉢ to cause something (such as dead plants and animals) to be slowly destroyed and broken down by natural processes, chemicals, etc.
- 4) _____ : ㉣ something that is produced during the production of something else
- 5) _____ : ㉤ involving questions of right and wrong behavior; relating to ethics

Questions & Answers

1. 1문단에서 틀린 문법 2개를 찾아 쓰고, 바르게 고친 후 틀린 이유를 쓰시오.

- ① _____ → _____ 이유 : _____
 ② _____ → _____ 이유 : _____

2. 1문단에서 문맥에 맞게 올바르게 순서배열 한 것을 고르시오.

- ① A C B ② B A C ③ B C A ④ C A B ⑤ C B A

3. 2문단에서 빈칸에 들어갈 스펠링을 쓰시오.

‘H□□□□’, ‘W□□□□’

4. 2문단에서 빈칸에 들어갈 단어로 적절하지 않은 단어를 고르시오.

- ① corruption ② contamination ③ pollution ④ purification ⑤ CO₂

4. 3문단에서 주어진 들어갈 가장 적절한 곳을 고르시오.

Above all, this isn't science fiction but it's already happening.

5. 4문단에서 ① ~ ⑤ 중 틀린 어휘를 찾아 쓰고, 바르게 고치시오.

_____ → _____

6. 5문단에서 빈칸에 공통으로 들어갈 단어 중 적절하지 않은 단어를 고르시오.

- ① moral ② arbitrary ③ ethical ④ altruistic ⑤ selfless

7. 5문단에서 주어진 문장을 해석에 맞게 **어순배열** 하시오.

*조건 1 : 괄호 안에 있는 단어는 **형태 변환** 시키시오

*조건 2 : 문법적으로 **필요한 단어를 포함** 시키시오.

해석 : 그것이 자연과 충돌하지 않고 조화롭게 함께 살아갈 수 있는 길을 열어준다.

어순배열 : { with nature / (collide) / without / in harmony / the way / us / to live together / opens }

It _____

내용파악

1. 수소연료전지가 ‘꿈의 기술(dream technology)’이라고 불리는 이유를 글의 내용을 바탕으로 두 가지 이상 서술하시오.

2. 수소연료전지의 작동 원리를 단계적으로 설명하시오. (전기 생성 과정을 중심으로)

3. 수소연료전지는 어떤 점에서 기존의 내연기관(내연기관 자동차 등)과 차별화되는지, 배출물과 관련하여 설명하시오.

4. 연료전지의 구성 요소 3가지를 쓰고, 각각의 역할을 간단히 설명하시오.

5. 글쓴이는 수소연료전지의 작동 원리를 ‘우주적 과정의 축소판’이라 하였다. 이 비유가 의미하는 바를 설명하시오.

6. 수소가 우주에서 갖는 상징적 의미를 철학적으로 서술하였다. 수소의 존재론적 또는 철학적 의미를 정리하여 서술하시오.

7. 현재 수소연료전지의 실용화가 진행 중인 사례를 두 가지 이상 글의 내용에 근거하여 설명하시오.

8. 수소연료전지 보급에 있어 가장 큰 기술적·사회적 장벽은 무엇인지, 글의 내용을 바탕으로 두 가지 이상 서술하시오.
9. 글쓴이는 화석연료와 수소를 각각 어떤 상징으로 제시하고 있는가? 그것이 문명에 주는 의미를 중심으로 설명하시오.
10. 수소연료전지 기술이 인류 문명과 자연 사이에 어떤 '화해의 길'을 열어줄 수 있는지, 글쓴이의 철학적 관점을 중심으로 서술하시오.
11. Which of the following statements is **NOT** consistent with the passage?
- ① Hydrogen fuel cells emit only water as a byproduct, making them environmentally friendly.
 - ② The energy conversion in fuel cells produces electricity directly from chemical energy.
 - ③ Hydrogen is the second most abundant element in the universe, following oxygen.
 - ④ Hydrogen fuel cells can be used in various sectors, including transportation and space exploration.
 - ⑤ One major challenge for hydrogen fuel cells is the lack of widespread refueling infrastructure.

대입 논술형 (서울대 스타일)

다음은 수소연료전지 기술에 대한 설명이다. 이를 읽고 아래 물음에 답하시오.

[자료]

수소연료전지는 수소와 산소의 전기화학 반응을 통해 전기를 생성하고, 그 부산물로는 물과 열만을 배출한다. 이러한 기술은 배출가스가 없어 환경오염을 유발하지 않으며, 우주에서 가장 풍부한 원소인 수소를 활용하여 지속가능한 에너지로 주목받고 있다. 그러나 수소의 생산, 저장, 유통을 위한 인프라와 안전성 문제, 그리고 경제적 비용 등의 장벽이 여전히 존재한다. 그럼에도 불구하고 이 기술은 '자연과의 화해'라는 상징적 의미를 지니며, 과거의 화석연료 의존적 문명에서 벗어나려는 인류의 새로운 전환점을 제시한다.

[문항]

수소연료전지는 기술적 이점뿐만 아니라 철학적 상징성을 갖는다고 평가받고 있다. 위 자료를 바탕으로,

- 1) 수소연료전지가 '꿈의 기술'로 불리는 이유를 과학적·기술적 측면과 철학적 측면으로 나누어 논술하시오.
- 2) 이러한 수소연료전지가 현실에서 직면하고 있는 주요 제약 요인을 두 가지 이상 제시하고, 그에 대한 해결 가능성을 본인의 견해와 함께 서술하시오.
- 3) 인간과 자연, 과학기술의 관계에 대한 자신의 생각을 위 자료를 바탕으로 논리적으로 서술하시오.