

**OR – 67**

## Hydrogen Cars

**A.** Record gas prices are making road trips more expensive than ever. But what if, instead of gas, your car ran on the most abundant element in our universe? Many experts think hydrogen will replace petrol, diesel and natural gas as the main fuel for cars, buses and trucks over the next few decades. Already car manufacturers around the world have invested billions of dollars in research and development.

**B.** The advantages of hydrogen are enormous: no more smog-forming exhaust gases, no more carbon dioxide emissions that contribute to global warming, no more worries about diminishing oil supplies and rising prices. But some tricky questions need to be answered before mass-produced hydrogen cars start appearing on the streets. Where will the hydrogen come from? How will motorists fill up? How will cars store the fuel? And there's also the question of how best to tap the energy in the fuel for good, on-road performance.

**C.** Two kinds of engines can use hydrogen as a fuel; those that have an internal combustion engine converted to use it and those that are made up of a stack of fuel cells. Internal combustion engines have powered cars since they first began to replace horse-drawn carriages more than 100 years ago. These engines can be converted to run on a variety of fuels, including hydrogen. However, most car makers think that fuel cells powering an electric motor offer a better alternative. Unlike heavy batteries that need frequent recharging, fuel cells make electricity as they go. Recent developments in technology to have greatly increased the amount of power that a stack of cells can provide. This has opened up the prospect of efficient, non-polluting electric cars.

**D.** Fuel cell technology sounds simple. The hydrogen fuel reacts with oxygen from the air to produce water and electricity, the reverse of the familiar electrolysis process that releases oxygen and hydrogen from water. In reality, of course, it's a bit more complicated. The big advantage of a fuel cell engine over an internal combustion engine running on hydrogen is its greater efficiency. The same amount of hydrogen will take a fuel cell car at least twice as far as one with a converted internal combustion engine.

**E.** Hydrogen has many advantages as a fuel for vehicles, but a big disadvantage is that it is difficult to store. This is because at normal temperatures hydrogen is a gas. The obvious solutions are to strongly compress the hydrogen or liquefy it. However, tanks designed to hold hydrogen at extremely high pressures, or at temperatures approaching absolute zero, are heavy and expensive. So, high cost and a large amount of energy needed to liquefy the fuel is likely to be the main problems with refuelling with liquid hydrogen. Filling up with compressed hydrogen gas will probably prove more practical, even though it may reduce the distance between fills. Cars could store the hydrogen under high-pressure tanks similar to those used for compressed natural gas or specially treated carbon may also hold large amounts.

**F.** Although there's no risk that we'll ever run out of hydrogen, on Earth, it exists naturally only in chemical compounds, not as hydrogen gas. A relatively simple principal technology, steam reforming, can produce hydrogen gas for cars at central plants or filling stations. Alternatively, fuel tanks could be filled with petrol or methanol, with the cars using onboard reformers to generate hydrogen for their fuel cells. This shows promise as a transitional measure while research proceeds on the problems of storing hydrogen. Water is the only potentially pollution-free source of hydrogen. Researchers are looking at new ways of producing hydrogen from water such as using algae, bacteria or photovoltaic cells to absorb sunlight and split water into hydrogen and oxygen. But the technology most likely to be adopted on a large scale is electrolysis, which uses an electric current to split water into oxygen and hydrogen.

**G.** Remember the Hindenburg' — that's a phrase often heard when hydrogen is discussed. This German passenger airship, kept aloft by hydrogen, crashed in flames as it came into land at Lakehurst, New Jersey, USA in May 1937. Thirty-five people died. Nowadays helium, which can't burn, is the gas of choice for the lighter-than-air craft. Hydrogen is highly flammable, but recent research has indicated that the airship's fabric, not hydrogen, was the culprit in the Hindenburg disaster. Properly handled, there's no reason to think hydrogen is any more dangerous as a fuel than petrol, the explosive liquid now carried safely in the tanks of untold millions of motor vehicles.

**H.** Recent technological advances, particularly in fuel cell design, have made hydrogen-powered cars a practical proposition, and carmakers expect to start mass-producing them within the next decade or so. Their power and acceleration should match those of today's conventionally-powered vehicles, but they may have to be refuelled more often. The best ways to produce, distribute and store the hydrogen still have to be sorted out. In the short term, fossil fuels may remain in demand as a hydrogen source. However, the idea that in the not too distant future

most of us will be driving non-polluting cars fuelled by hydrogen from a clean, renewable source is no longer a flight of fantasy.

Questions 1-7

Reading Passage has 8 paragraphs (A-H).

From the list of headings below choose the most suitable headings for paragraphs B-H

- 1. Paragraph B
- 2. Paragraph C
- 3. Paragraph D
- 4. Paragraph E
- 5. Paragraph F
- 6. Paragraph G
- 7. Paragraph H

**List of Headings**

- i. Hydrogen Storage
- ii. Traditional Production Methods
- iii. The Possible Danger of Combustible Hydrogen
- iv. A Plentiful Alternative
- v. Looking Forward
- vi. Good Idea but .....
- vii. Today's Hydrogen Production
- viii. How the Process Works
- ix. Hydrogen Sources and Production
- x. The Workings of the Internal Combustion Engine
- xi. The Engine Dilemma

Questions 8- 12

Write NO MORE THAN THREE WORDS for each answer.

Write your answers in boxes 8-12 on your answer sheet.

- 8. There is no reason that we'll run out of hydrogen as it's the \_\_\_\_\_ that exists.
- 9. \_\_\_\_\_ have been devoted by companies to producing hydrogen cars.
- 10. \_\_\_\_\_ could use traditional fuels to produce the hydrogen needed to power hydrogen cars.
- 11. Investigations have proved that \_\_\_\_\_ was the cause of the Hindenburg disaster.
- 12. Hydrogen cars have the potential to offer the \_\_\_\_\_ that we associate with today's fossil fuel-powered vehicles.

Questions 13 and 14

Choose the appropriate letters A-D

- 13. Which of the following is NOT a potential problem with the introduction of hydrogen cars?
  - A. The frequency of refueling stops.
  - B. The creation of by-products of the electricity production process.
  - C. The volatility of hydrogen.
  - D. Keeping hydrogen in cars.
- 14. Which of the following hydrogen production methods for hydrogen powered cars is viewed in the article as a temporary measure?
  - A. A system producing hydrogen from fossil fuels.
  - B. A method producing hydrogen from water vapor.
  - C. A process using microscopic organisms to produce hydrogen.
  - D. An electrolysis basis hydrogen production system.

**Answers – OR 67**

1. iv
2. xi
3. viii
4. i
5. ix
6. iii
7. v
8. MOST ABUNDANT ELEMENT
9. BILLIONS OF DOLLARS
10. ON-BOARD REFORMERS
11. THE AIRSHIP'S FABRIC
12. POWER AND ACCELERATION
13. B
14. A

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