Name: _____ **Date:** _____

Chemistry *~ Ms. Hart* **Class:** Anions or Cations

Marking Period 4 – Argumentative Writing Readings

Hybrids vs. Hydrogen: Which Future Is Brighter?

Nov. 29, 2004
By AMANDA ONION
http://abcnews.go.com/Technology/Hybrid/story?id=266883&page=3
Thirsty? Imagine bending down to your car tailpipe and taking a big slurp.

Hydrogen-powered vehicles could make that possible (though you'd probably prefer to get your drinking water elsewhere). Unlike gasoline-driven combustion engines, the hydrogen fuel cell generates power not by burning, but through a chemical reaction in which hydrogen and oxygen are converted into energy with water as the only byproduct. It's not just clean, as a fuel source, hydrogen offers nearly three times the energy of gasoline since it burns hotter and faster.

The concept of such a clean car is appealing, but a growing number of critics are saying it's time to wake up and embrace technologies, such as gas-electric hybrid vehicles, that they say are more feasible. "The things that matter here are energy security, climate change and air pollution," said David Keith of the Department of Engineering and Public Policy at Carnegie Mellon University in Pittsburgh. "Focusing on fuel-cell cars makes no economic sense for any of these goals."

President Bush declared in his 2003 State of the Union address that he aimed to have hydrogen-powered cars on the road in significant numbers by 2020 and pledged $1.2 billion in federal money for the effort. The energy department followed up this year by including $318 million for both fuel cells and hydrogen production in its 2005 budget.

But in the past year, two reports, one from the National Academy of Sciences and another in the journal "Science," plus a recently published book have all argued that placing such focus on hydrogen fuel-cell vehicles may be counterproductive. A better, more viable solution could lie in a technology that is already catching on -- the hybrid vehicle.

"We already have a technology that can reduce emissions by 30 (percent) to 50 percent," said Joseph Romm, chief official for alternative fuels for the Department of Energy under President Clinton and author of the book "The Hype About Hydrogen: Fact and Fiction in the Race to Save the Climate." "So I think hybrids, not fuel cells, should be the focus of government policy for the next two decades."

Burning Natural Gas to Get Hydrogen

Romm and others point out that hydrogen is a fuel carrier, not a fuel source, which means it must be produced from other sources. While the hope is renewable resources, such as windpower, might someday be used to produce hydrogen, right now the most cost-efficient way of making it is from natural gas in a process that releases carbon dioxide into the atmosphere. And that, critics say, defeats the purpose of switching to hydrogen in the first place.

"I have a light bulb in my room and it's not emitting carbon dioxide -- it's perfectly clean," said Keith, who co-authored the July 2003 "Science" paper that argued against a rush toward hydrogen fuel cells. "But that's not the point. The point is producing the electricity to power it is polluting."

Then there is the major challenge of developing hydrogen-fueling stations and supply systems to service the fleet of hydrogen powered cars. In mid-November, Shell opened its first hydrogen service

station outside Washington, D.C. The station is one of some 22 new stations for fuel-cell and hydrogen-powered vehicles built in the past year.

But many more will be needed if the nation is to be equipped with "hydrogen highways," as California Gov. Arnold Schwarzenegger has described his state's hopeful future network of more than 200 hydrogen fuel stations. So far the state has only two.

"The challenges in developing a fuel-cell car and the needed infrastructure (structures) are enormous," said Romm. "You might say, 'It's the infrastructure, stupid.'"

Car company representatives dismiss such claims as "ridiculous" and contend there's no reason why the automotive industry can't pursue hybrid vehicle and hydrogen fuel-cell technology at the same time.

"Hydrogen fuel cells are only the long-term part of our strategy to reducing fuel consumption," said Kyle Johnson, an engineer with General Motors. "In the short term, we're continuing to improve our fuel combustion engines. Then in the mid-term, we will bring out hybrids ... in the long term, we continue to contribute resources to fuel cells."

Tom Watson, chief engineer for Ford's fuel-cell program, maintains the company is hopeful the hydrogen vehicle concept does have a future. He adds that much of what they learn in designing hydrogen fuel-cell vehicles can and has been applied in their gas hybrid models. "We believe that fuel-cell vehicles have a future in the marketplace," he said. "The only question is in the timing."

While it may take a while to develop lines of fuel cells, several car companies, including Ford, General Motors and BMW are adjusting combustion engines so they burn on hydrogen.

California Law Could Help Hybrids

Regardless of how far long it may take to develop a hydrogen infrastructure, could there be any harm in working toward one? Keith argues that federal money would be better spent in advancing the design and sales of hybrid vehicles. Right now, federal support of the part gasoline-powered, part electric-powered vehicles is a $2,000 tax deduction, which will sunset to $500 in 2006 and expire by 2007.

That's not enough, says Keith. Federal money could be invested in hybrids to improve their customer appeal and help make them more efficient.

On the other hand, hybrid vehicles appear to be growing quite popular on their own. About 47,500 hybrid vehicles were sold in the United States in 2003, according to data released last week by J.D. Power. In 2005, the company predicts 206,000 hybrids will be sold.

As it is, spiraling gas prices have already given hybrids a boost.

Electric Cars vs. Hydrogen Fuel Cell Cars

by Christopher Lampton, adapted by Ms. Hart

http://auto.howstuffworks.com/electric-cars-vs-hydrogen-fuel-cell-cars.htm

What in the world is a hydrogen fuel cell car? It runs on a motor powered by electricity. What makes it different from a battery-electric vehicle (or BEV) is where the electricity comes from. Instead of a battery, a hydrogen fuel cell car has, well, a hydrogen fuel cell. This is a device that takes hydrogen, the most abundant element in the universe, and generates electricity from it while the car is running. In effect, a hydrogen fuel cell is a kind of battery that makes electricity on the fly.

To see how this works, let's take a quick refresher course in high school chemistry. Hydrogen is the smallest, lightest atom in existence. A hydrogen atom consists of two things: a proton (which has a positive electric charge) and an electron (which has a negative electric charge). The hydrogen fuel cell strips these two things apart, so that the electrons are free to go their own way and become the electricity that runs the car's motor. (Electricity is nothing more a continuous flow of electrons.) Meanwhile, the proton becomes a hydrogen ion -- that is, a hydrogen atom with a positive electric charge -- and will bond together with any oxygen atoms in the vicinity to form water. (Water – or H_2O as the chemistry geeks call it – is nothing more than two hydrogen ions with an oxygen atom attached.) This process releases a lot of heat, so the water becomes steam and the steam becomes the exhaust of the hydrogen fuel cell.

The great thing – and the green thing – about hydrogen fuel cell cars is that they don't produce any pollution at the tailpipe (unless you consider the steam being produced by the hydrogen fuel cell to be a form of pollution).

While fuel cell cars do not produces pollution at the tailpipe, they have the potential to produce pollution when their "fuel" is created. The fuel that a hydrogen fuel cell car runs on is hydrogen (which is used to generate electricity). That hydrogen has to come from somewhere. The hydrogen for the fuel cell vehicle will most likely be produced in the future by electrolysis, which involves passing electricity through water. And that electricity will come from the same potentially polluting sources as the electricity used to charge the electric car's batteries.

The truth is, hydrogen fuel cell cars have the potential to be wonderfully non-polluting forms of transportation, but to make them truly green we'll need to move away from methods of producing electricity that burn fossil fuels. Instead of burning coal to generate electricity, we'll need to concentrate on environmentally clean methods like hydropower, solar power, wind power and nuclear power, which produce little or no polluting emissions. When the day comes that most of our electricity comes from these sources, the hydrogen fuel cell car will be a nearly perfect form of green, non-polluting transportation.

1. What is the main idea of this article?

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Toyota Passing Over Electric Vehicles for More Hybrids, Hydrogen Fuel Cell Vehicles

Tiffany Kaiser - October 1, 2013 1:19 PM

http://www.dailytech.com/Toyota+Passing+Over+EVs+for+More+Hybrids+Hydrogen+Fuel+Cell+Vehicles/article33471.htm

The automaker doesn't see a market for Electric Vehicles (EVs).

Toyota doesn't see a market for electric vehicles (EVs), but it does see value in continued hybrid production and upcoming hydrogen fuel cell technology.

Back in August, Toyota revealed that it would release 15 new hybrids by 2015.

In addition, Toyota is bypassing EVs and betting on fuel cell technology, where hydrogen is ran through the fuel cell with only water as a byproduct. The company wants to release its first hydrogen fuel cell vehicle in 2015.

"I personally expect a lot from this hydrogen fuel cell technology," said Uchiyamada. "If government and industry work together, this might be part of the long-term solution."

2. What impact do you think Toyota's decision has on research and progress for hydrogen fuel cell and hybrid car technology?

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How Hybrid Cars Work

by Karim Nice and Julia Layton

http://auto.howstuffworks.com/hybrid-car.htm

Have you pulled your car up to the gas pump lately and been shocked by the high price of gasoline? As the pump clicked past $20, $30, $40 or even $50, maybe you thought about trading in your car for something that gets better mileage. Or maybe you're worried that your car is contributing to the greenhouse effect.

The auto industry has the technology to address these concerns. It's the **hybrid car**. There are a lot of hybrid models on the market these days, and most automobile manufacturers have announced plans to manufacture their own versions.

The hybrid is a compromise. It attempts to significantly increase the mileage (amount of miles a car can drive before it needs more gasoline) and reduce the emissions of a gas-powered car while overcoming the shortcomings of an electric or hydrogen fuel cell car.

To be useful, a car must meet certain minimum requirements. The car should be able to:

- Drive at least 300 miles (482 km) before re-fueling
- Be refueled quickly and easily
- Keep up with the other traffic on the road

A gasoline car meets these requirements but produces a relatively large amount of pollution and generally gets poor gas mileage. An electric car, however, produces almost no pollution, but it can only go 50 to 100 miles (80 to 161 km) between charges. And the problem has been that the electric car is very slow and inconvenient to recharge.

A gasoline-electric (hybrid) car combines these two setups into one system that maximizes both gas power and electric power.

- **Recover energy and store it in the battery** - Whenever you step on the brake pedal in your car, you are removing energy from the car. The faster a car is going, the more **kinetic** energy it has. The brakes of a car remove this energy and dissipate it in the form of heat. A hybrid car can capture some of this energy and store it in the battery to use later. It does this by using "regenerative braking." That is, instead of just using the brakes to stop the car, the electric motor that drives the hybrid can also slow the car. In this mode, the electric motor acts as a generator and charges the batteries while the car is slowing down.

- **Sometimes shut off the engine** - A hybrid car does not need to rely on the gasoline engine all of the time because it has an alternate power source -- the electric motor and batteries. So the hybrid car can sometimes turn off the gasoline engine, for example when the vehicle is stopped at a red light.

3. What is one question you have about hybrid cars?

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Hydrogen Fuel Cell Benefits and Challenges

http://www.fueleconomy.gov/feg/fcv_benefits.shtml

Benefits

Less Greenhouse Gas Emissions: Gasoline- and diesel-powered vehicles emit greenhouse gases (GHGs), mostly carbon dioxide (CO_2), that contribute to global climate change. Fuel cell vehicles (FCVs) powered by pure hydrogen emit no GHGs from their tailpipe, only heat and water. Producing the hydrogen to power FCVs *can* generate GHGs, depending on the production method, but much less than that emitted by conventional gasoline and diesel vehicles.

Reduced Oil Dependence: FCVs could reduce our dependence on foreign oil since hydrogen can be derived from domestic sources, such as natural gas and coal, as well as renewable resources such as water, biogas, and agricultural waste. That would make our economy less dependent on other countries and less vulnerable to oil price shocks from an increasingly volatile oil market.

Less Air Pollutants: Highway vehicles emit a significant share of the air pollutants that contribute to smog and harmful particulates in the U.S. FCVs powered by pure hydrogen emit no harmful pollutants. If the hydrogen is produced from fossil fuels, some pollutants are produced, but much less than the amount generated by conventional vehicle tailpipe emissions.

Challenges

Fuel cell vehicles are not yet commercially available, but a few hundred are being evaluated in field tests. Several challenges must be overcome before fuel cell vehicles (FCVs) will be a successful, competitive alternative for consumers.

Vehicle Cost: FCVs are currently more expensive than conventional vehicles and hybrids, but costs have decreased significantly and are approaching DOE's goal for 2017 (see graph). Manufacturers must continue to lower production costs, especially for the fuel cell stack and hydrogen storage, for FCVs to compete with conventional technologies.

Onboard Hydrogen Storage: Some FCVs store enough hydrogen to travel as far as gasoline vehicles between fill-ups—about 300 to 400 miles—but this must be achievable across different vehicle makes and models and without compromising customer expectations of space, performance, safety, or cost.

Fuel Cell Durability and Reliability: Fuel cell systems are not yet as durable as internal combustion engines, especially in some temperature and humidity ranges. Fuel cell stack durability in real-world environments is currently about half of what is needed for commercialization. Durability has increased substantially over the past few years from 29,000 miles to 75,000 miles, but experts believe a 150,000-mile expected lifetime is necessary for FCVs to compete with gasoline vehicles.

Getting Hydrogen to Consumers: The current infrastructure for producing, delivering, and dispensing hydrogen to consumers is cannot yet support the widespread adoption of FCVs. In 2013, H2USA was launched as a public-private partnership between DOE and other federal agencies, automakers, state government, academic institutions, and additional stakeholders to coordinate research and identify cost-effective solutions for deploying hydrogen infrastructure.

Public Education: Fuel cell technology must be embraced by consumers before its benefits can be realized. As with any new vehicle technology, consumers may have concerns about the dependability and safety of these vehicles when they first hit the market. Plus, they must become familiar with a new kind of fuel. Public education can accelerate this process.

4. Do you think the positives outweigh the negatives for Hydrogen Fuel Cell cars?

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