

- (d) Student responses will vary depending on how passionately they feel about the environment. The production of Ni–Cd batteries should not be banned because they are popular and widely used. They meet our needs at a reasonable cost. Alternatives are too expensive.
- (e) The leaflet or letter will vary depending on the strength of the student’s position. However, the writing should clearly state the student’s position, and reasons for it.

5.11 TECH CONNECT: HYDROGEN FUEL CELLS

TECH CONNECT 5.11 QUESTIONS

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Understanding Concepts

1. The primary difference between a fuel cell and an alkaline dry cell is that the chemicals used to generate electricity in a fuel cell are continually fed into the device while the reaction products are continually removed. This allows the fuel cell to provide an uninterrupted supply of electricity. An alkaline cell has only a finite supply of chemicals, and stops generating electricity once its chemicals are consumed.
2. The waste product from the hydrogen–oxygen fuel cell is water.
3. As a fuel, hydrogen is only as clean as the energy used to produce it. Hydrogen produced using a renewable energy resource, like light or geothermal energy, is considered “clean.” Hydrogen produced using energy from a polluting source, like the combustion of fossil fuels, defeats the purpose of creating a non-polluting fuel.

Making Connections

4. A safe and convenient method of producing small quantities of hydrogen must be available so that the consumer can readily re-supply the phone with fuel. This could either be in the form of small cylinders of compressed hydrogen available at local stores, or through a safe home hydrogen-generating device.
5. Reforming technology involves extracting hydrogen from conventional hydrocarbon fuels like methane and methanol. This process (for methanol) generally involves two steps:
 - (i) splitting methanol, using a catalyst

$$\text{CH}_3\text{OH}_{(g)} \xrightarrow{\text{catalyst}} \text{CO}_{(g)} + 2 \text{H}_{2(g)} \text{ and}$$
 - (ii) oxidizing carbon monoxide

$$\text{CO}_{(g)} + \text{H}_2\text{O}_{(g)} \rightarrow \text{CO}_{2(g)} + \text{H}_{2(g)}$$

Unfortunately, this process also produces carbon dioxide—a greenhouse gas. The good news, however, is that the amount of carbon dioxide released would be considerably less than the amount released by burning gasoline.
6. Iceland has a great deal of hydroelectric and geothermal energy sources that can be developed to produce the “clean” electricity required to generate hydrogen gas.

5.12 CORROSION

CAREER CONNECTION: PLUMBER

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- (i) A common situation in which metals can be mismatched occurs when fasteners, such as nuts, bolts, and washers, are used to hold metallic objects together. Unless all the fastening components are made of the same metal, corrosion can occur. This form of corrosion is sometimes called galvanic corrosion. Galvanic corrosion can also occur when metal roof or siding products are installed. A plastic liner is sometimes used to cover nail heads in the framing lumber of a roof, to prevent the nails from coming into direct contact with the metal roof. Galvanic corrosion also occurs where chrome-plated (or nickel-plated) accessories are bolted to steel car bodies. The corrosion of steel is accelerated.
- (ii) Lead was banned from use in solder because of its toxicity. Lead from the solder can be oxidized, becoming toxic lead(II) ions in drinking water.
- (iii) A number of community colleges offer plumbing apprenticeship programs. The basic entrance requirements for these programs include:
 - a solid science background
 - Grade 10 Mathematics (applied or academic)