

Chem / Envsty L111:
Spring 2007
Quiz 10 (The Last One!)

Name _____

- During the chemical reaction in an electrochemical cell,
 - a substance is oxidized and gains control over electrons.
 - electrons travel from the cathode to the anode.
 - oxidation may take place without there also being reduction.
 - oxidation occurs at the anode. 14/22 correct
- In a galvanic cell,
 - oxidation takes place at the cathode.
 - electrolytes are added to carry electrons between electrodes.
 - oxidation and reduction take place at the same time at different electrodes. 16/22
 - electrical energy is used to reverse spontaneous chemical reactions.
- The opposite of a galvanic cell is
 - a battery.
 - an electrolytic cell. 11/22!
There are two kinds of electrochemical cell: galvanic and electrolytic.
Galvanic cells produce electricity from spontaneous reactions, and electrolytic cells drive non-spontaneous reactions using electricity
 - a fuel cell.
 - a photovoltaic (solar) cell.
- Which type of widely used battery is **not** rechargeable?
 - alkaline 20/22
 - lithium-ion
 - lead-acid (storage batteries)
 - nickel-cadmium (NiCad)
- Which is an oxidation half-reaction?
 - $2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$
 - $\text{Zn} \rightarrow \text{Zn}^{2+} + 2 \text{e}^-$ 18/22
 - $2 \text{HCl} + \text{Ba}(\text{OH})_2 \rightarrow 2 \text{H}_2\text{O} + \text{BaCl}_2$
 - $\text{Cl}_2 + 2 \text{e}^- \rightarrow 2 \text{Cl}^-$
- A major advantage of a fuel cell over a standard battery is that
 - as long as oxygen and fuel are supplied, a fuel cell will not "run down" like a battery will. 20/22
 - a fuel cell generates electricity without the need for an oxidation-reduction reaction.
 - a fuel cell is 100% efficient at generating electricity, whereas a battery is less than 1% efficient.

- d. as it generates electricity, a fuel cell produces more fuel than it uses.
7. Which is **not** a current or planned use for the electricity generated by fuel cells?
- a. as the output of small power plants
 - b. to operate space shuttles
 - c. to control nuclear fusion 12/22
 - d. to power a cell phone
8. What condition must be met for a battery to be rechargeable?
- a. Either its anode or its cathode must generate a gas as a result of the electrochemical reaction.
 - b. It must generate electricity via an acid-base reaction rather than via an oxidation reduction reaction.
 - c. The battery must be open to the outside so that it can vent any internal pressure that builds up from gases within it.
 - d. The electrochemical reaction of the battery must be reversible. 18/22
9. In 1997, General Motors introduced a car powered only by batteries, the Saturn EV-1. The batteries were recharged by plugging them into a standard electrical outlet. Why was it inappropriate to consider this vehicle as non-polluting?
- a. The exhaust produced by the car contained carbon dioxide, carbon monoxide and other pollutants.
 - b. The electrical power plants that generated the electricity used to recharge the car's batteries release greenhouse gases and other pollutants into the atmosphere. 19/22
 - c. Even though the car's motor was powered electrically, the car had to burn gasoline in order to get it started.
 - d. Every car in use today has a battery. The Saturn EV-1 is no different, and it pollutes like all other cars pollute.
10. At present, it will be difficult and perhaps inappropriate to develop an economy based on burning hydrogen rather than natural gas or gasoline because
- a. hydrogen is a dirty fuel. Burning hydrogen produces significantly more pollutants than burning natural gas or gasoline.
 - b. hydrogen is not an efficient fuel. Per gram, hydrogen has about the lowest heat of combustion of any known substance, much lower than natural gas or gasoline.
 - c. although hydrogen is abundant, pure hydrogen is not found naturally on earth. Hydrogen is difficult or expensive to isolate and collect. 20/22
 - d. being such a light element, hydrogen will not flow through pipelines the way natural gas or gasoline do. Hydrogen cannot easily be delivered from where it is produced to the places where it is needed.