Weekly Question Why do batteries die?

Many materials—from potatoes and lemons to stacks of metal coins—can be used to make a battery. All you need is a material that has the ability to produce a flow of electrons. The first battery, demonstrated by Count Alessandro Volta in 1800, was a stack of discs made of alternating kinds of metal separated by paper soaked with salt water. It was that simple.

Today, batteries come in a variety of materials with different properties. Batteries can be disposable or rechargeable, and they can be made of various compounds such as lithium ion, nickel cadmium, or metal hydride. The different materials used to construct batteries result in differences in the amount of electric current produced, the size and cost of the battery, and the lifetime of the battery. But no matter what material is used, eventually every battery “dies” and stops producing electricity.

A. Write true or false.

1. Only metals can be used to make a battery.  
2. Eventually, a battery stops producing electricity.  
3. Batteries have the ability to generate a flow of electrons.

B. Name four ways that batteries can differ from one another, depending on the different materials used to construct them.

1.  
2.  
3.  
4.  

Vocabulary

current  
KUR-int the flow of electricity through a conductor

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Weekly Question

Why do batteries die?

Batteries generate electricity through a type of chemical reaction called an electrochemical reaction. During this particular kind of reaction, the reactants combine to create new substances and, in the process, produce electrons.

Whether or not a reaction produces electrons depends on the chemical properties of the reactants. Chemical properties are determined by the chemical composition of a substance and, in turn, control a substance’s ability to undergo a particular chemical change. For example, a substance might have the tendency to rust, to catch on fire, to form an acid, or to explode. Unlike a physical property, which can be observed without changing a substance’s composition or structure, a chemical property can be observed or measured only when a substance undergoes a chemical change.

A. Next to each example of a substance’s property, write whether the property is physical or chemical.

1. Hydrogen explodes when ignited.
2. Copper is a reddish-orange, shiny metal.
3. Silver reacts with moisture to form tarnish.
4. Metal corrodes when exposed to air.
5. Water freezes at 32°F.

B. Explain in your own words the difference between physical and chemical properties.
**Weekly Question**

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Think of a battery as a reaction chamber filled with chemicals. For example, a typical car battery consists of a series of compartments, each containing a pair of **electrodes** immersed in a kind of acid called sulfuric acid. One electrode is made of lead, and the other electrode is made of lead oxide. Electrodes are where a battery's electrochemical reactions take place, and different reactions take place on different electrodes.

On the lead electrode of a car battery, the lead reacts with sulfuric acid to form a new compound called lead sulfate. This reaction produces electrons, and negative charges build up on the lead electrode.

On the lead oxide electrode, the material also reacts with sulfuric acid to produce lead sulfate. However, this reaction removes electrons from the electrode. As a result, positive charges collect on the lead oxide electrode. When the two electrodes are connected in an electrical circuit, electrons flow from the negatively charged electrode to the positively charged electrode, and electricity is produced.

**A. Complete the analogy.**

**Sulfuric acid** is to **reactant** as **lead sulfate** is to ____________________.

**B. Use words from the passage to complete the paragraph.**

The lead electrode in a car battery reacts with the acid solution to form ____________________, and this reaction ____________________ electrons.

The lead oxide electrode reacts with the solution to form the same compound, but this reaction ____________________ electrons.
Weekly Question

Why do batteries die?

A battery contains only a fixed amount of reactants, so as soon as these reactants have been used up, the reaction stops and the battery goes dead. A dead battery produces no more electrons and no more electricity.

However, some batteries can be recharged by connecting them to a source of electricity such as a wall outlet. This is possible because the electrochemical reactions that create electricity are reversible. When a battery is recharging, electricity flows in the opposite direction. In a car battery, this allows the lead sulfate that coats both of the electrodes to dissolve back into the acid solution. Lead and lead oxide re-form on each of the electrodes. This process of recharging uses energy itself, but when the battery is reconnected to the car, the electrochemical reaction that produces electricity can start all over again.

A. Number the steps in the correct order to show how a battery is recharged.

   ____ Lead sulfate dissolves into the acid solution.
   ____ The battery is connected to a source of electricity.
   ____ Lead and lead oxide re-form on the electrodes.
   ____ The battery produces electrons.

B. Name two devices you have used or seen that have rechargeable batteries. Then name the source of the energy that you would use to recharge them.

1. _______________________________________________________
2. _______________________________________________________

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