STEM Sims™

Charge

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Do you need an idea for a scientific study?
Try out one of our ideas or make one of your own.

Start learning right now about energy conversion. Take the following brief quiz to see how much you already know about charging devices. See the bottom of page 4 to check your answers.

1. In 2008, two female students at Harvard developed an energy converter that uses which sports item to make enough energy to charge a cell phone?
   a. A cricket bat
   b. A soccer ball
   c. A baseball mitt
   d. A basketball hoop

2. Which of the following designs has *not* been patented as a device charger?
   a. hand grip charger
   b. yo-yo charger
   c. trampoline charger
   d. Rubik's cube charger

3. When reading a circuit schematic diagram, a diode is shown as:
   a. 
   b. 
   c.
   d. 

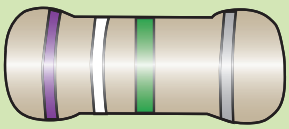
4. Current (I) measured in amps multiplied by resistance (R) measured in ohms is equal to:
   a. capacity (C) measured in farads
   b. charge (Q) measured in coulumbs
   c. power (P) measured in watts
   d. voltage (V) measured in volts

5. Water, light, heat, chemicals, wind, and sound can all be converted into usable energy.
   a. true
   b. false

Resistance is Futile

While the Borg might believe that "Resistance is futile," resistance is actually a very useful measurement in electrical circuits. Resistance (measured in ohms [Ω]) is equal to the voltage divided by the current. A resistor (which looks something like the figures below) is used to reduce current and lower voltage. Different resistance measurements are needed in different circumstances. In order to determine the resistance of each resistor, colors are used to measure the first and second digits, the multiplier, and the tolerance. In the lines below the resistors, fill out the amount of ohms (and use k for 1000s and M for 1000000s).

1st Digit	2nd Digit	Multiplier	Tolerance
0	0	1	
1	1	10	1%
2	2	100	2%
3	3	1000	
4	4	10000	
5	5	100000	
6	6	1000000	
7	7		
8	8	0.1 Gold	5% Gold
9	9	0.01 Silver	10% Silver



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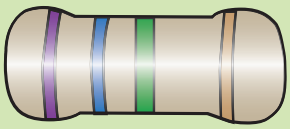

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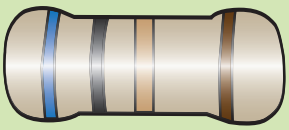

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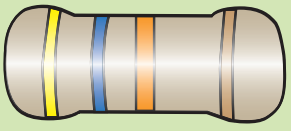

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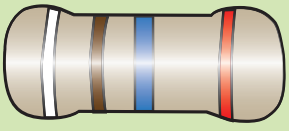

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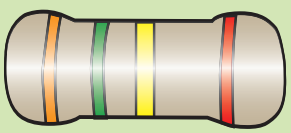

_____ Ω

Charge

Charge ‘em up, Scotty!

With the ever increasing prevalence of mobile technologies, users are finding themselves in constant need of recharging their devices. While the devices themselves require electrical energy, the ways that the electricity is delivered varies from charger to charger. And despite the law of conservation of energy that states that energy can neither be created nor destroyed, it can be converted. Engineers have been picking up on this concept and using as many forms as possible to create innovative solutions to everyday problems of electrical charge needs. Heat can be converted into electric energy by steam engines or geothermal, oceanic thermal, or thermoelectric processes. Batteries and fuel cells can convert chemical energy into electric energy. Photovoltaic cells can convert sunlight into usable energy. But most of these take place on large scales. When it comes to charging mobile devices, smaller solutions are required.

Pioneering engineers have come up with brilliant solutions, converting mechanical kinetic processes into usable electric energy. SolePower, for example, developed removable soles for the shoes that convert the mechanical energy of walking two and a half miles into enough electrical energy to completely charge an iPhone. iYo converts playing with a yo-yo into electric energy that is output via a USB charger. A Rubik’s cube charger has even been designed so that playing it converts magnetic energy into usable electric energy via a USB cable.

And in the DIY (do it yourself) era, it is easier and easier to find tutorials on how to make your own cool chargers! But in order to make something like a solar-powered phone charger, it is important to understand the concepts of energy conversion as well as how to read and use circuit schematic diagrams. You will also want to be able to determine energy efficiency benefits and drawbacks of each type of charger. For example: is it waterproof? how much will it cost? how small and portable is it? what is the peak power?

Please visit our site for more helpful information:

STEMsims.com

Answers: Page 2 Answers: 1) b, called the Socket. 2) c. 3) b, a is ground, c is resistor, d is battery. 4) d. 5) a. **Page 3 Answers:** (top to bottom, left to right(1) 7900 kiloOhms +/-10% 2) 0.6 Ohms +/- 1% 3) 91000 kiloOhms +/-2% 4) 7600 kiloOhms +/-5% 5) 46 kiloOhms +/-5% 6) 350 kiloOhms +/-5%

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