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| Electrical power | | | | | | | | | | | |
| Content | This lesson defines electric power and examines household electrical systems and power usage. Students learn how power is related to current, voltage, and resistance, and how to calculate the power and energy use of common appliances. The lesson presents examples of power in electric circuit elements connected in both series and parallel combinations. | | | | | | | | | | |
| Learning objectives | The student will be able to:calculate the power used by electric circuit elements connected in parallel combinations; andcalculate the power used by electric circuit elements connected in series combinations. | | | | | | | | | | |
| Materials/technology resources | 1. Slide presentation: “ElectricalPower.ppt” 2. Investigation: Modular Circuits Kit 3. Interactive calculators: “Electric power calculator” 4. Student work: “ElectricalPowerAssignment.pdf” 5. SPARKvue File “ElectricalPower.spklab” | | | | | | | | | | |
| Lesson plan segments | * Whole group discussion: Escalator A lifts 50 passengers per minute from the first floor to the second floor. Escalator B needs two minutes to do the same amount of work and create the same amount of potential energy. So what’s the difference? The difference is their *power: the rate at which they do work*. Escalator A has more power. Electrical power is the rate at which electrical energy is used to create light, heat, or mechanical energy. * Investigation: In this investigation, students measure the power and energy output of two resistors in two different circuits using a voltage and current sensor. The resistors are wired in series in Part 1 and in parallel in Part 2. Students analyze their results by answering qualitative questions based on their observations. | | | | | | | | | | Macintosh HD:Users:tomhsu:Desktop:Icon_Tiffs:Auditory.tif Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Interpersonal.tif |
|  | * Slide presentation: The presentation defines power, relates power to the basic quantities of current, voltage, and resistance, and models the use of the interactive calculators for computing power. Parallel circuits and fuses for household wiring are described, and the energy cost of common appliances is calculated. | | | | | | | | | | Macintosh HD:Users:tomhsu:Desktop:Icon_Tiffs:Auditory.tifMacintosh HD:Users:tomhsu:Desktop:Icon_Tiffs:Visual.tif |
|  | * Student work: *Electrical power* assignment   The assignment provides practice in calculating current, voltage, resistance, or power from the power equations, and in calculating energy use. Encourage students to complete the assignment sheet independently and then discuss their answers with a partner. Student pairs could volunteer to put solutions on the board. | | | | | | | | | | Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:linguistic.tif Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Interpersonal.tif  Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Logical.tif |
|  | * Reading: from the *Essential Physics* textbook, pages 494 - 496 | | | | | | | | | | Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:linguistic.tif |
| Assessment evidence | **Objective 1**: Two 30 Ω resistors are connected in parallel to a 120 volt outlet.  (*in slide presentation*)   1. How much current flows through the circuit? answer: 8 amps      1. What is the power output of this circuit? answer: 960 watts     **Objective 2**: Two 30 Ω resistors are connected in series to a 120 volt outlet.  (*in slide presentation*)   1. How much current flows through the circuit? answer: 2 amps      1. What is the power output of this circuit? answer: 240 watts | | | | | | | | | | |
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| Prior knowledge | Students are familiar with the concepts of current, voltage, and resistance. They can identify and analyze series and parallel circuits using Ohm’s law, the equations for *Req*, and Kirchhoff’s laws. | | | | | | | | | | |
| Equations | electrical power: | | | | | | | | | | |
| Vocabulary | power circuit breaker  watt (W) kilowatt-hour (kWh) | | | | | | | | | | |
| Standards | The student is expected to:   * calculate the power used by electric circuit elements connected in both series and parallel combinations. | | | | | | | | | | |
| Crosscutting concepts | Patterns | Cause  and  Effect | | Systems  and  Models | Energy  and  Matter | | Structure  and  Function | Stability  and  Change | | Scale, Proportion, Quantity | |
| * Power is the rate at which work is done or energy is transferred or transformed. | | | | | | | | | | |
| Key to differentiated instruction: | | | visual Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Visual.tif | | | linguistic Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:linguistic.tif | | | auditory Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Auditory.tif | | |
| interpersonal Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Interpersonal.tif | | | intrapersonal Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Intrapersonal.tif | | | kinesthetic Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Kinesthetic.tif | | | logical Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Logical.tif | | |