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| Compound circuits | | |
| Content | Compound circuits contain combinations of series and parallel arrangements. Students learn to calculate the equivalent resistance of compound circuits. In a hands-on activity, students predict the relative brightness of lamps in a compound circuit by relating brightness to the equations for power, and experiment with a voltage divider circuit. | |
| Learning objectives | The student will be able to:identify compound circuits;calculate the equivalent resistance of a compound circuit; andpredict relative bulb brightness in a compound circuit. | |
| Materials/technology resources | 1. Slide presentation: “CompoundCircuits.ppt” 2. Investigation: Modular Circuits Kit: batteries (2), switch, lamps (3),   resistors (3), wire modules, current sensor, voltage sensor   1. Student work: “CompoundCircuitsAssignment.pdf” 2. SPARKvue File “17F\_CompountCircuits.spklab” | |
| Lesson plan segments | * Slide presentation: Students learn to distinguish between series, parallel, and compound circuits. The slide presentation presents a step-by-step approach to calculating the equivalent resistance of a compound circuit by identifying and combining resistors in series or in parallel. In this way, a complex circuit can be reduced to a single equivalent resistance. Two complete examples are provided. | Macintosh HD:Users:tomhsu:Desktop:Icon_Tiffs:Visual.tifMacintosh HD:Users:tomhsu:Desktop:Icon_Tiffs:Auditory.tif |
|  | * Investigation: In part 1 of the investigation, students predict the brightness of bulbs in a compound circuit. They build the circuit, test their predictions, and explain their observations using the equations for power and/or Kirchhoff’s laws. In part 2, students build a voltage divider circuit and collect data on the output voltage as they vary the values of the resistors. They analyze their results in order to develop a mathematical model for predicting the output voltage as a function of the chosen resistors. | Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Kinesthetic.tif Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Interpersonal.tif |
|  | * Student work: *Compound circuits* assignment   The student assignment provides a place for students to record the predictions and data from their investigation, and includes additional practice problems on compound circuits. | Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:linguistic.tif Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:Logical.tif |
|  | * Reading: from the *Essential Physics* textbook, pages 497 - 498 | Macintosh HD:Users:tomhsu:Desktop:  TeacherMaterials:Icon_Tiffs:linguistic.tif |

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| Assessment evidence | Macintosh HD:Users:tomhsu:Desktop:objective1.tif**Objective 1**: Identify each circuit as a series, parallel, or compound arrangement. (*in slide presentation*)    answers:  A. compound  B. series  C. parallel  D. compound  Macintosh HD:Users:tomhsu:Desktop:objective2Prob.tif**Objective 2**: For the circuit shown, calculate the equivalent resistance and the current through the battery. (*in slide presentation*)  answers: *Req* = 50 Ω, *I* = 2 amps.  Macintosh HD:Users:tomhsu:Desktop:Objective3prob.tif  **Objective 3**: The bulbs in this circuit are identical. Rank the bulbs in order of brightness, from brightest to dimmest. Explain. (*in slide presentation*)  answer: The B is brightest. A and C are the same.  *P = I*2*R.* Since resistances are equal, the bulb with more current is brighter. B has twice as much current. | | | | | | | | | |
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| Prior knowledge | Students should be familiar with the equivalent resistance of resistors in series and parallel, and be able to apply Kirchhoff’s laws to currents and voltage drops. | | | | | | | | | |
| Vocabulary | compound circuit voltage divider equivalent resistance | | | | | | | | | |
| Standards | The student is expected to:   * calculate resistance of electric circuit elements connected in 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 |
| * The equivalent resistance and total current flow of a compound circuit is determined by (caused by) the particular arrangement of resistors. * Lamp brightness is an indication of power: the rate at which electrical energy is transformed into light and heat. | | | | | | | | | |
| 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 | |