

Honors Physics – Ch 18 Practice Problems

1. A 3 mm thick steel wire that stretches for 5531 km has a resistance of about 82 k Ω . If you connect in series three resistors with the values 16 k Ω , 22 k Ω , and 32 k Ω , what value must the fourth resistor have for the equivalent resistance to equal 82 k Ω ?

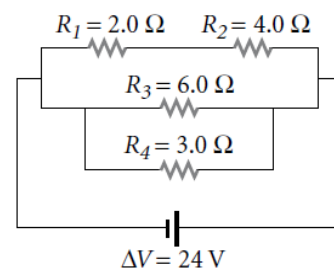
2. The Large Electron Positron ring, near Geneva, Switzerland, is one of the biggest scientific instruments on Earth. The circumference of the ring is 27 km. A copper wire with this length and a cross-sectional area of 1 mm² will have a resistance of about 450 Ω . Consider a parallel connection of three resistors with resistances equal to 1.0, 2.0, and 0.50 times the resistance of the copper wire, respectively. What is the equivalent resistance?

3. The total length of the telephone wires in the Pentagon is 3.22×10^5 km. Suppose these wires have a resistance of 1.0×10^{-2} Ω /m. If all the wires are cut into 1.00×10^3 km pieces and all pieces are connected in parallel to a AA battery ($\Delta V = 1.50$ V), what would the current through the wires be? Assume that a AA battery can sustain this current.

4. If you were to swim in the Atlantic off the coast of Brazil, the resistance of your body could drop as low as 100 Ω . An electric eel in Brazil can have a potential difference of up to 650 V across it. If you came into contact with this eel while swimming, what current would be delivered to your body?

5. The largest piece of gold ever found had a mass of about 70 kg. If you were to draw this mass of gold out into a thin wire with a cross-sectional area of 2.0 mm², the wire would have a length of 1813 km. The wire would also have a resistance per unit length of 1.22×10^{-2} Ω /m.
 - a. What is the resistance of the wire?
 - b. Suppose the wire were cut into pieces having resistance of exactly 1/2, 1/4, 1/5, and 1/20 of the wire's resistance. If these pieces are reconnected in parallel, what is the equivalent resistance of the four pieces?

6. In 1920, there was an electric car that could travel at about 40 km/h and that had about a 45 km range. The car was powered by a 24 V battery. Suppose this battery is connected to a combination of resistors, as shown in the circuit diagram to the right. What is the battery current?



7. The longest-lasting battery in the world is at Oxford University, in England. It was built in 1840 and was still working in 1977, producing a 1.0×10^{-8} A current. The battery provided a potential difference of 2.0×10^3 V. If the battery is connected to a group of resistors, as shown in the circuit diagram to the right, find the value of the equivalent resistance and the value of r .

