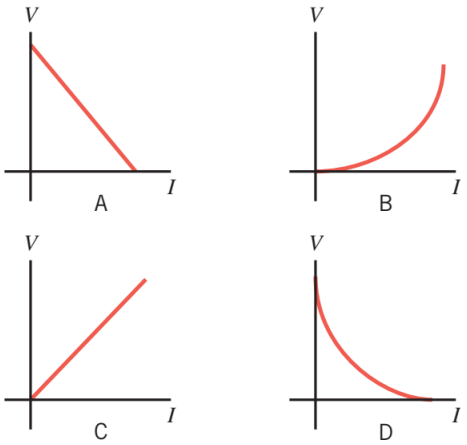
INSTITUT TEKNOLOGI BANDUNG
FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
PROGRAM STUDI FISIKA
Jl. Ganesha No 10 Bandung 40132 Indonesia

TUTORIAL MODULE 3, ELEMENTARY PHYSICS IIB (FI-1202))
Semester 2, Academic Year 2019-2020
TOPIC : DIRECT CURRENT

A. QUESTION

1. Which one of the following graphs correctly represents Ohm's law, where V is the voltage and I is the current? **(a)** A, **(b)** B, **(c)** C, **(d)** D.



2. Two wires are made from the same material. One wire has a resistance of 0.10 Ω. The other wire is twice as long as the first wire and has a radius that is half as much. What is the resistance of the second wire? **(a)** 0.40 Ω, **(b)** 0.20 Ω, **(c)** 0.10 Ω, **(d)** 0.050 Ω, **(e)** 0.80 Ω.

3. For the circuit shown in the drawing, what is the voltage V_1 across resistance R_1?

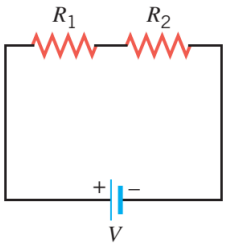


Fig. question no. 3

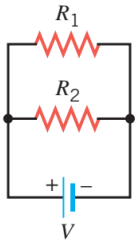


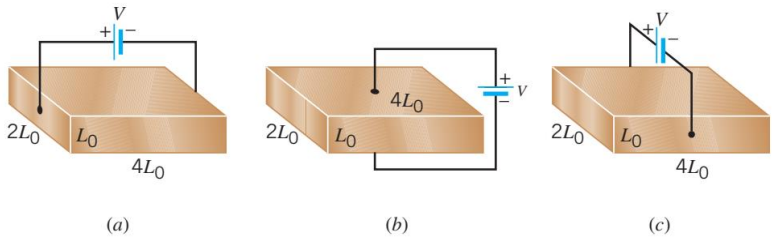
Fig. question no. 4

4. For the circuit shown in the drawing, what is the ratio of the current I_1 in resistance R_1 to the current I_2 in resistance R_2?

5. A battery has an emf of V and an internal resistance of r. What resistance R, when connected across the terminals of this battery, will cause the terminal voltage of the battery to be ½ V ?
(a) $R = ½\ r$, (b) $R = 2r$, (c) $R = 4r$, (d) $R = r$, (e) $R = ¼\ r$.

B. PROBLEMS

1. The resistance and the magnitude of the current depend on the path that the current takes. The drawing shows three situations in which the current takes different paths through a piece of material. Each of the rectangular pieces is made from a material whose resistivity is $\rho = 1.50\times10^{-2}$ Ω.m, and the unit of length in the drawing is $L_0 = 5.00$ cm. Each piece of material is connected to a 3.00-V battery. Find **(a)** the resistance and **(b)** the current in each case.



2. A coil of wire has a resistance of 38.0 Ω at 25 °C and 43.7 Ω at 55 °C. What is the temperature coefficient of resistivity?

3. The temperature coefficient of resistivity for the metal gold is 0.0034 $(C°)^{-1}$, and for tungsten it is 0.0045 $(C°)^{-1}$. The resistance of a gold wire increases by 7.0% due to an increase in temperature. For the same increase in temperature, what is the percentage increase in the resistance of a tungsten wire?

4. The drawing shows two circuits, and the same battery is used in each. The two resistances R_A in circuit A are the same, and the two resistances R_B in circuit B are the same. Knowing that the same total power is delivered in each circuit, find the ratio R_B/R_A for the circuits.

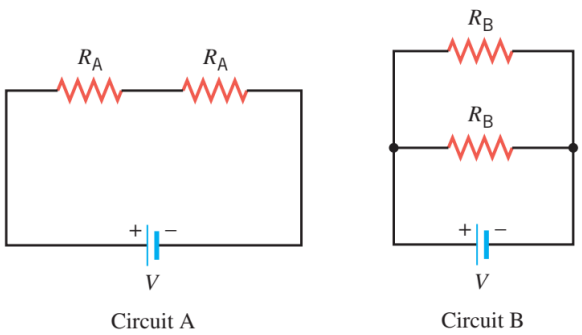


Fig. problem no. 4

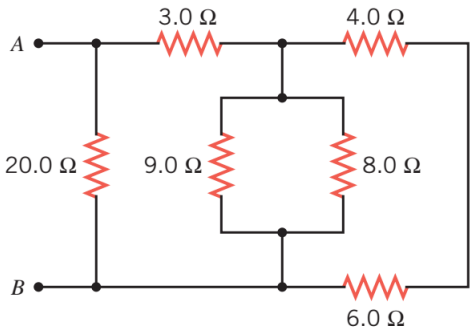


Fig. problem no. 5

5. Determine the equivalent resistance between the points *A* and *B* for the group of resistors in the drawing.

6. The circuit in the drawing contains five identical resistors. The 45-V battery delivers 58 W of power to the circuit. What is the resistance *R* of each resistor?

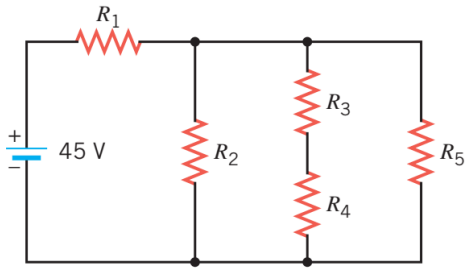


Fig. problem no. 6

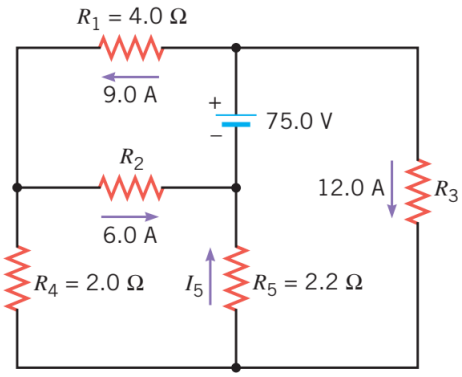


Fig. problem no. 7

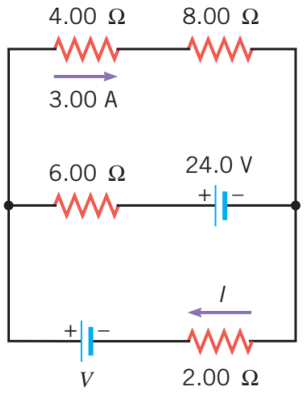


Fig. problem no. 8

7. None of the resistors in the circuit shown in the drawing is connected in series or in parallel with one another. Find (a) the current I_5 and the resistances (b) R_2 and (c) R_3.

8. For the circuit shown in the drawing, find the current *I* through the 2.00- resistor and the voltage *V* of the battery to the left of this resistor.

9. An aluminum wire is hung between two towers and has a length of 175 m. A current of 125 A exists in the wire, and the potential difference between the ends of the wire is 0.300 V. The density of aluminum is 2700 kg/m^3. Find the mass of the wire.

10. Two 3.8-μF capacitors, two 2.2-kΩ resistors, and a 16.0-V source are connected in series. Starting from the uncharged state, how long does it take for the current to drop from its initial value to 1.50 mA?

11. Consider the circuit shown in fig., where all resistors have the same resistance R. At $t = 0$, with the capacitor C uncharged, the switch is closed. (*a*) At $t = 0$, the three currents can be determined by analyzing a simpler, but equivalent, circuit. Draw this simpler circuit and use it to find the values of I_1, I_2, and I_3 at $t = 0$. (*b*) At $t = \infty$, the currents can be determined by analyzing a simpler, equivalent circuit. Draw this simpler circuit and implement it in finding the values of I_1, I_2, and I_3 at $t = \infty$. (*c*) At $t = \infty$, what is the potential difference across the capacitor?

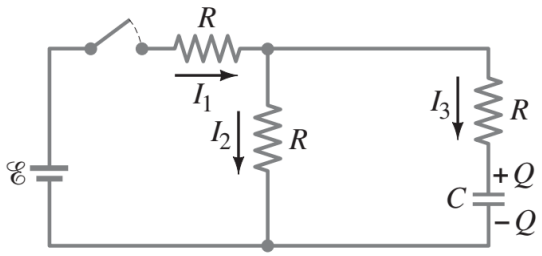


Fig. problem no. 12

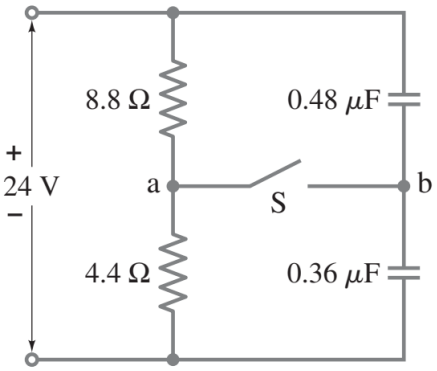


Fig. problem no. 13

12. Two resistors and two uncharged capacitors are arranged as shown in fig. Then a potential difference of 24 V is applied across the combination as shown. (*a*) What is the potential at point a with switch S open? (Let V = 0 at the negative terminal of the source.) (*b*) What is the potential at point b with the switch open? (*c*) When the switch is closed, what is the final potential of point b? (*d*) How much charge flows through the switch S after it is closed?