Physics 161.002
Clicker Quiz: March 6, 2007

4. Four wires meet at a junction. The first carries 4A into the junction, the second carries 5A out of the junction, and the third carries 2A out of the junction. The fourth carries:
   A) 7A out of the junction
   B) 7A into the junction
   C) 3A out of the junction
   ✓D) 3A into the junction
   E) 1A into the junction

$\Sigma I_i = 0$
$\therefore +4 -5 -2 + I_4 = 0$
$\therefore I_4 = 3A$ into junct.

8. A battery is connected across a series combination of two identical resistors. If the potential difference across the terminals is V and the current in the battery is i, then:
   A) the potential difference across each resistor is V and the current in each resistor is i
   B) the potential difference across each resistor is V/2 and the current in each resistor is i/2
   C) the potential difference across each resistor is V and the current in each resistor is i/2
   ✓D) the potential difference across each resistor is V/2 and the current in each resistor is i
   E) none of the above are true

9. A battery is connected across a parallel combination of two identical resistors. If the potential difference across the terminals is V and the current in the battery is i, then:
   A) the potential difference across each resistor is V and the current in each resistor is i
   B) the potential difference across each resistor is V/2 and the current in each resistor is i/2
   ✓C) the potential difference across each resistor is V and the current in each resistor is i/2
   D) the potential difference across each resistor is V/2 and the current in each resistor is i
   E) none of the above are true

16. Nine identical wires, each of diameter d and length L, are connected in parallel. The combination has the same resistance as a single similar wire of length L but whose diameter is:
   ✓A) 3d
   B) 9d
   C) d/3
   D) d/9
   E) d/81

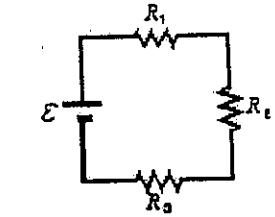
$R = \frac{\rho L}{A} = \frac{\rho L}{\pi (d/2)^2}$
$R_{11} = R/9 = \rho L / \pi (D/2)^2$
$\therefore D = 3d$

19. Two wires made of the same material have the same length but different diameter. They are connected in series to a battery. The quantity that is the same for the wires is:
   A) the end-to-end potential difference
   ✓B) the current
   C) the current density
   D) the electric field
   E) the electron drift velocity

26. The emf of a battery is equal to its terminal potential difference:
   A) under all conditions
   B) only when the battery is being charged
   C) only when a large current is in the battery
   ✓D) only when there is no current in the battery
   E) under no conditions

$V_{terminal} = \mathcal{E} \pm I r_{internal}$

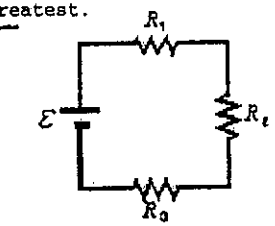
30. In the diagram R1 > R2 > R3. Rank the three resistors according to the current in them, least to greatest.



   A) 1, 2, 3
   B) 3, 2, 1
   C) 1, 3, 2
   D) 3, 1, 2
   ✓E) All are the same

30P. In the diagram R1 > R2 > R3. Rank the three resistors according to the voltage drops across them, least to greatest.

$V_i = I R_i$

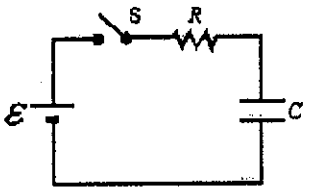


   A) 1, 2, 3
   ✓B) 3, 2, 1
   C) 1, 3, 2
   D) 3, 1, 2
   E) All are the same

46. In an antique automobile, a 6-V battery supplies a total of 48 W to two identical headlights in parallel. The resistance (in ohms) of each bulb is:
   A) 0.67
   ✓B) 1.5
   C) 3
   D) 4
   E) 8

$\text{Power} = 2 \times \frac{V^2}{R}$ (2 = # lights)
$\therefore R = \frac{2V^2}{\text{Power}} = \frac{2 \times (6V)^2}{48W} = 1.5\Omega$

59. Four circuits have the form shown in the diagram. The capacitor is initially uncharged and the switch S is open.



The values of the emf, resistance "R", and capacitance "C" for each for the circuits are
   circuit 1: emf = 18 V, R = 3 ohms, C = 1 microF
   circuit 2: emf = 18 V, R = 6 ohms, C = 9 microF
   circuit 3: emf = 12 V, R = 1 ohms, C = 7 microF
   circuit 4: emf = 10 V, R = 5 ohms, C = 7 microF

$I = 18V/3\Omega = 6A$
$= 18V/6\Omega = 3A$
$= 12V/1\Omega = 12A$
$= 10V/5\Omega = 2A$

Rank the circuits according to the current just after switch S is closed least to greatest.
   A) 1, 2, 3, 4
   B) 4, 3, 2, 1
   ✓C) 4, 2, 3, 1
   D) 4, 2, 1, 3
   E) 3, 1, 2, 4

because at "t=0" voltage across the capacitor $= \frac{Q(t=0)}{C} = 0$

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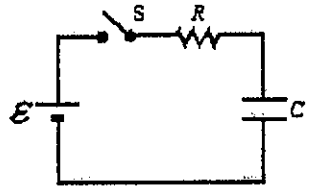

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$RC = 3\times10^{-6}\,s = 3\,\mu s$
$= 6\times9\times10^{-6}\,s = 54\,\mu s$
$= 1\times7\times10^{-6}\,s = 7\,\mu s$
$= 5\times7\times10^{-6}\,s = 35\,\mu s$

Rank the circuits according to the time after the switch "S" is closed for the capacitor to reach half their final charge, least to greatest.

A) 1, 2, 3, 4
B) 4, 3, 2, 1
C) 1, 3, 4, 2
D) 4, 2, 1, 3
E) 3, 1, 2, 4

→ depends on $\tau = RC$