Q28.29 Suppose $\varepsilon = 12\text{ V}$ and each lamp has $R = 2\ \Omega$. Before the switch is closed the current is $\frac{12\text{ V}}{6\ \Omega} = 2\text{ A}$. The potential difference across each lamp is $(2\text{ A})(2\ \Omega) = 4\text{ V}$. The power of each lamp is $(2\text{ A})(4\text{ V}) = 8\text{ W}$, totaling 24 W for the circuit. Closing the switch makes the switch and the wires connected to it a zero-resistance branch. All of the current through A and B will go through the switch and (b) lamp C goes out, with zero voltage across it. With less total resistance, the (c) current in the battery $\frac{12\text{ V}}{4\ \Omega} = 3\text{ A}$ becomes larger than before and (a) lamps A and B get brighter. (d) The voltage across each of A and B is $(3\text{ A})(2\ \Omega) = 6\text{ V}$, larger than before. Each converts power $(3\text{ A})(6\text{ V}) = 18\text{ W}$, totaling 36 W, which is (e) an increase.

P28.6 (a) $$R_p = \frac{1}{(1/7.00\ \Omega)+(1/10.0\ \Omega)} = 4.12\ \Omega$$

$$R_s = R_1 + R_2 + R_3 = 4.00 + 4.12 + 9.00 = \boxed{17.1\ \Omega}$$

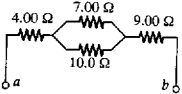

FIG. P28.6

(b) $\Delta V = IR$

$34.0\ \text{V} = I(17.1\ \Omega)$

$I = \boxed{1.99\ \text{A}}$ for $4.00\ \Omega$, $9.00\ \Omega$ resistors.

Applying $\Delta V = IR$, $(1.99\ \text{A})(4.12\ \Omega) = 8.18\ \text{V}$

$8.18\ \text{V} = I(7.00\ \Omega)$

so $I = \boxed{1.17\ \text{A}}$ for $7.00\ \Omega$ resistor

$8.18\ \text{V} = I(10.0\ \Omega)$

so $I = \boxed{0.818\ \text{A}}$ for $10.0\ \Omega$ resistor.

P28.24 We name the currents I_1, I_2, and I_3 as shown.

[1] $70.0 - 60.0 - I_2(3.00\ \text{k}\Omega) - I_1(2.00\ \text{k}\Omega) = 0$

[2] $80.0 - I_3(4.00\ \text{k}\Omega) - 60.0 - I_2(3.00\ \text{k}\Omega) = 0$

[3] $I_2 = I_1 + I_3$

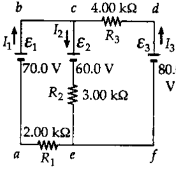

FIG. P28.24

(a) Substituting for I_2 and solving the resulting simultaneous equations yields

$I_1 = \boxed{0.385\ \text{mA}}$ (through R_1)

$I_3 = \boxed{2.69\ \text{mA}}$ (through R_3)

$I_2 = \boxed{3.08\ \text{mA}}$ (through R_2)

(b) $\Delta V_{cf} = -60.0\ \text{V} - (3.08\ \text{mA})(3.00\ \text{k}\Omega) = \boxed{-69.2\ \text{V}}$

$\boxed{\text{Point } c \text{ is at higher potential.}}$

P28.36 (a) $\tau = RC = \left(1.50\times10^{5}\ \Omega\right)\left(10.0\times10^{-6}\ \text{F}\right) = \boxed{1.50\ \text{s}}$

(b) $\tau = \left(1.00\times10^{5}\ \Omega\right)\left(10.0\times10^{-6}\ \text{F}\right) = \boxed{1.00\ \text{s}}$

(c) The battery carries current $\dfrac{10.0\ \text{V}}{50.0\times10^{3}\ \Omega} = 200\ \mu\text{A}$.

The 100 kΩ carries current of magnitude $I = I_0 e^{-t/RC} = \left(\dfrac{10.0\ \text{V}}{100\times10^{3}\ \Omega}\right)e^{-t/1.00\ \text{s}}$.

So the switch carries downward current $\boxed{200\ \mu\text{A} + \left(100\ \mu\text{A}\right)e^{-t/1.00\ \text{s}}}$.

P28.71 (a) After steady-state conditions have been reached, there is no DC current through the capacitor.

Thus, for R_3: $\boxed{I_{R_3} = 0 \text{ (steady-state)}}$.

For the other two resistors, the steady-state current is simply determined by the 9.00-V emf across the 12-kΩ and 15-kΩ resistors in series:

For R_1 and R_2: $$I_{(R_1+R_2)} = \frac{\varepsilon}{R_1+R_2} = \frac{9.00 \text{ V}}{(12.0 \text{ k}\Omega + 15.0 \text{ k}\Omega)} = \boxed{333\ \mu\text{A (steady-state)}}.$$

(b) After the transient currents have ceased, the potential difference across C is the same as the potential difference across $R_2 (= IR_2)$ because there is no voltage drop across R_3. Therefore, the charge Q on C is

$$Q = C(\Delta V)_{R_2} = C(IR_2) = (10.0\ \mu\text{F})(333\ \mu\text{A})(15.0 \text{ k}\Omega)$$
$$= \boxed{50.0\ \mu\text{C}}.$$

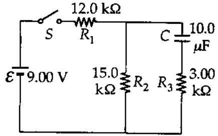

FIG. P28.71(b)