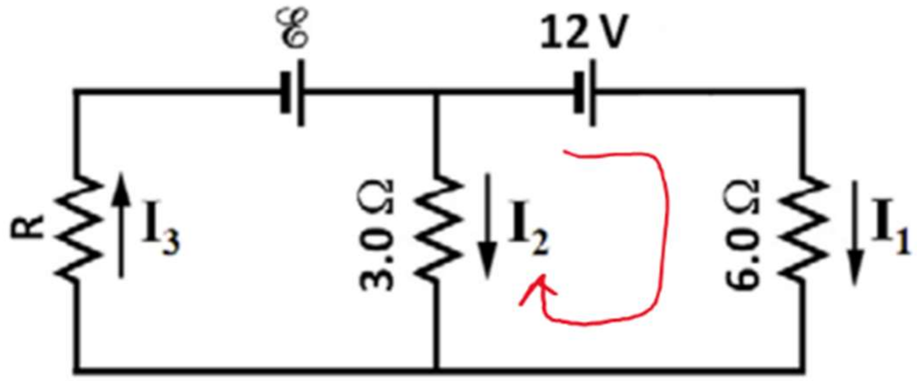
Q1 F-112-15

In the circuit, the current I_1 = 3.0 A. What is the value of current I_3?

A) 5.0 A
B) 1.0 A
C) 13 A
D) 7.0 A
E) 6.0 A



$$12 - 6I_1 + 3I_2 = 0$$

$$12 - 6(3) + 3I_2 = 0$$

$$\Rightarrow I_2 = \frac{-12+18}{3} = 2\ A$$

$$I_3 = I_1 + I_2 = 2A + 3A = 5A$$

Q2 F-122-15

What are the resistance R and the emf ε of the battery in the figure.

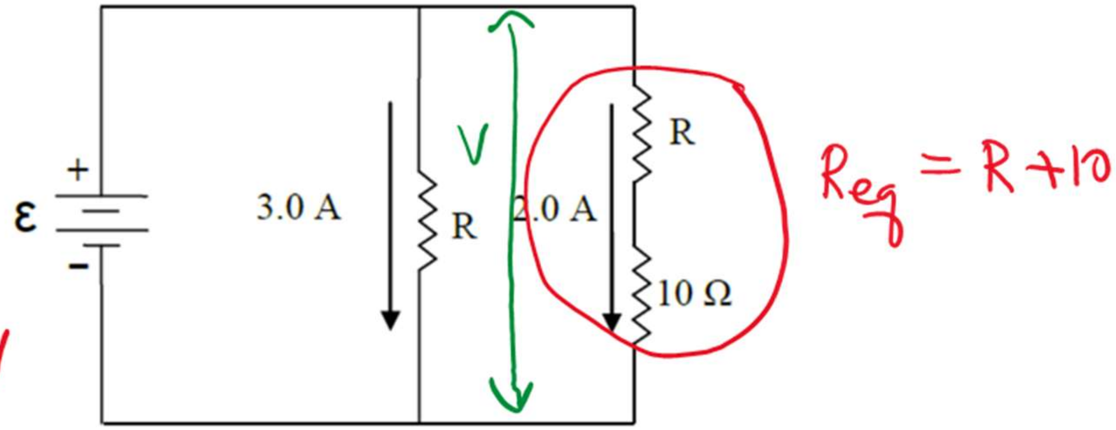
A) R= 20 Ω, ε = 60 V
B) R= 10 Ω, ε = 60 V
C) R= 10 Ω, ε = 30 V
D) R= 20 Ω, ε = 50 V
E) R= 15 Ω, ε = 45 V

$\varepsilon = V = 3R = 2R_{eq}$

$\Rightarrow 3R = 2(R+10)$

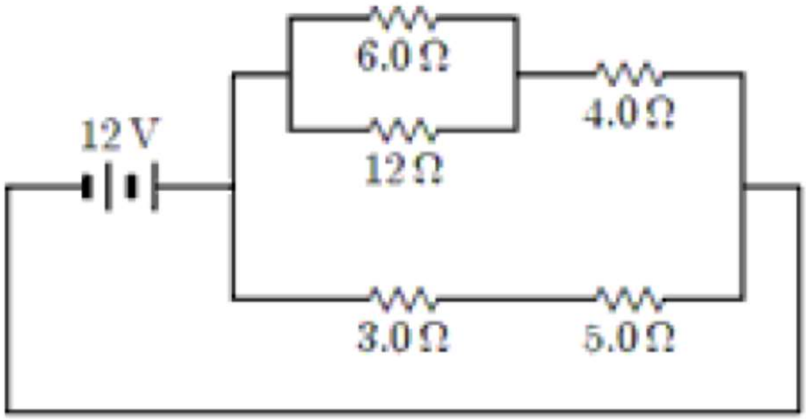
$R = 20\ \Omega$

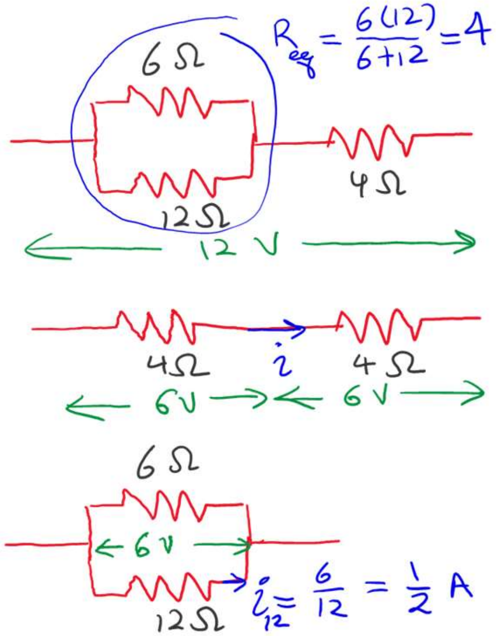
$\Rightarrow \varepsilon = 3(20) = 60\ V$



The current in the 12-Ω resistor shown in the circuit of the figure is:

A) 0.50 A
B) 1.5 A
C) 2.5 A
D) 2.0 A
E) 0.30 A





$R_{eq} = \frac{6(12)}{6+12} = 4\ \Omega$

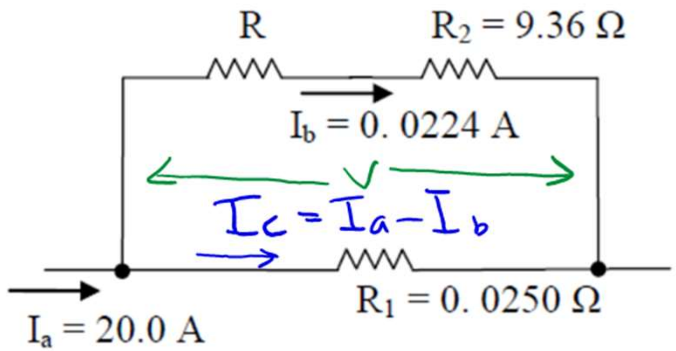
$i = \frac{12}{4+4} = \frac{12}{8} = \frac{3}{2}$ A

$i_{12} = \frac{6}{12} = \frac{1}{2}$ A

Q4 F-142-12

In the figure, find the resistance R,

A) 12.9 Ω
B) 10.0 Ω
C) 16.2 Ω
D) 14.3 Ω
E) 18.8 Ω



$$V = I_c R_1 = I_b (R + R_2)$$

$$(I_a - I_b) R_1 = I_b (R + R_2)$$

$$R = \frac{I_a R_1 - I_b R_1 - I_b R_2}{I_b}$$

$$R = \frac{I_a}{I_b} R_1 - R_1 - R_2 = \left(\frac{I_a}{I_b} - 1\right) R_1 - R_2$$

$$R = \left(\frac{20}{0.0224} - 1\right) 0.025 - 9.36 = 12.9\ \Omega$$

Q5 F2-122-16

A 1.0 μF capacitor with an initial stored energy of 0.50 J is discharged through 1.0 MΩ resistor. Find the charge on the capacitor at t = 0.40 s.

A) 6.7×10^{-4} C
B) 3.7×10^{-4} C
C) 1.3×10^{-4} C
D) 9.4×10^{-4} C
E) 7.3×10^{-4} C

initial stored energy $U_0 = \frac{q_0^2}{2C} = 0.5\ J$

$\Rightarrow q_0 = \sqrt{U_0(2C)} \Rightarrow q_0 = \sqrt{(0.5)(2)(1\times10^{-6})}$

$\Rightarrow q_0 = 1\times10^{-3}$ F

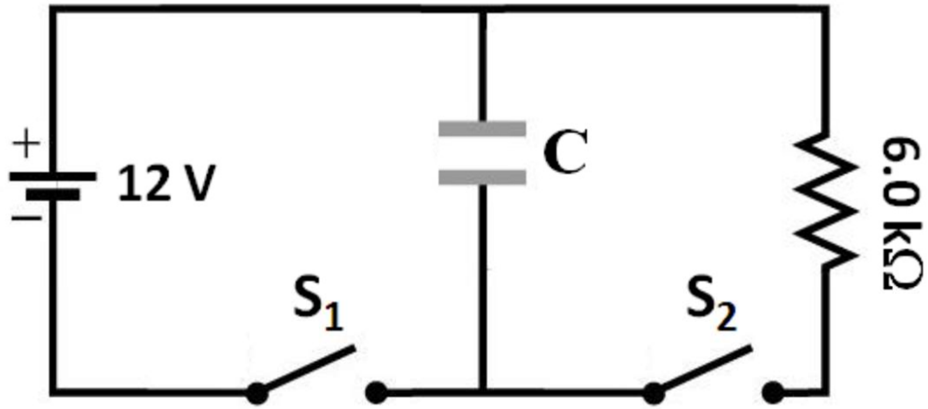
$q(t) = q_0 e^{-t/RC}$

$q(t=0.4s) = 1\times10^{-3} e^{-0.4/(1\times10^{-6}\times1\times10^{6})}$ C

$= 10^{-3} e^{-0.4} = 6.7\times10^{-4}$ C

Q6 F-112-16

A capacitor of capacitance C is connected to a 12-V battery, as shown in the figure. First, switch S_2 was open, and switch S_1 was closed until the capacitor is fully charged. Then, S_1 is open and S_2 is closed. If the voltage across the capacitor decays and reaches 6.0 V after 0.10 s, the *capacitance* C *is equal* to



A) 24 μF
B) 11 μF
C) 14 μF
D) 140μF
E) 47 μF

$q_0 = C(12)$

$q(t) = q_0 e^{-t/RC}$

$V(t) = \frac{q(t)}{C} = \frac{q_0}{C} e^{-t/RC}$

$V(t) = \frac{C(12)}{C} e^{-t/RC} \Rightarrow 6 = 12 e^{-0.1/RC}$

$\ln \frac{6}{12} = \ln e^{-0.1/RC} \Rightarrow \ln 2 = \frac{0.1}{RC} \Rightarrow C = \frac{0.1}{R \ln 2}$

$\Rightarrow C = \frac{0.1}{(6 \times 10^3) \ln 2} = 24 \mu F$