Solution to HW Problems

Chapter 28

104 Phys

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6. (a) Find the equivalent resistance between points a and b in Figure P28.6. (b) A potential difference of 34.0 V is applied between points a and b. Calculate the current in each resistor.

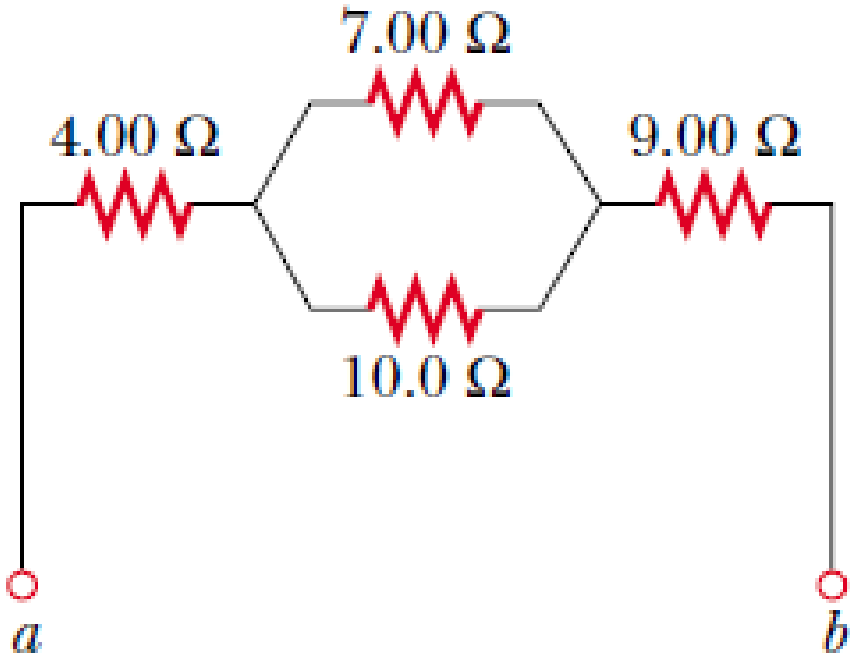
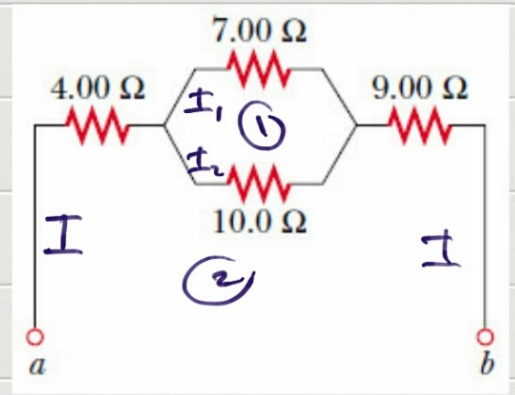


Figure P28.6

P 6/28:



step#1: ① 7 and 10 Ω in //

→ $R_{①} = [\frac{1}{7} + \frac{1}{10}]^{-1} = 4.12\ \Omega$

step # 2: ① + ② ⇒

$R_{eq} = 4 + 4.12 + 9 = 17.12\ \Omega$ //

b) $\because V = IR \rightarrow I = \frac{34}{17.12} = 1.99\ A.$

$\because I_{4\Omega} = I_{9\Omega} = 1.99\ A.$

for 7 and 10 Ω: $\because R_{①} = 4.12\ \Omega$ $\because V = IR \rightarrow V_{①} = 1.99 \times 4.12 = 8.2\ V$

$\therefore I_7 = \frac{8.2}{7} = 1.17\ A$ and $I_{10} = \frac{8.2}{10} = 0.82\ A$ //

12. Using only three resistors—2.00 Ω, 3.00 Ω, and 4.00 Ω—find 17 resistance values that may be obtained by various combinations of one or more resistors. Tabulate the combinations in order of increasing resistance.

P 12/ 28:

1st. in series only:

① 2 Ω only
② 3 Ω only
③ 4 Ω only
④ 2+3
⑤ 2+4
⑥ 3+4
⑦ 2+3+4

2nd in // only:

⑧ $\frac{1}{2}$ only
⑨ $\frac{1}{3}$ only
⑩ $\frac{1}{4}$ only
⑪ $\frac{1}{2}+\frac{1}{3}$
⑫ $\frac{1}{2}+\frac{1}{4}$
⑬ $\frac{1}{3}+\frac{1}{4}$
⑭ $\frac{1}{2}+\frac{1}{3}+\frac{1}{4}$

seriest // only:

⑮ $\frac{1}{2+3}+\frac{1}{4}$
⑯ $\frac{1}{2+4}+\frac{1}{3}$
⑰ $\frac{1}{3+4}+\frac{1}{2}$

21. Determine the current in each branch of the circuit shown in Figure P28.21.

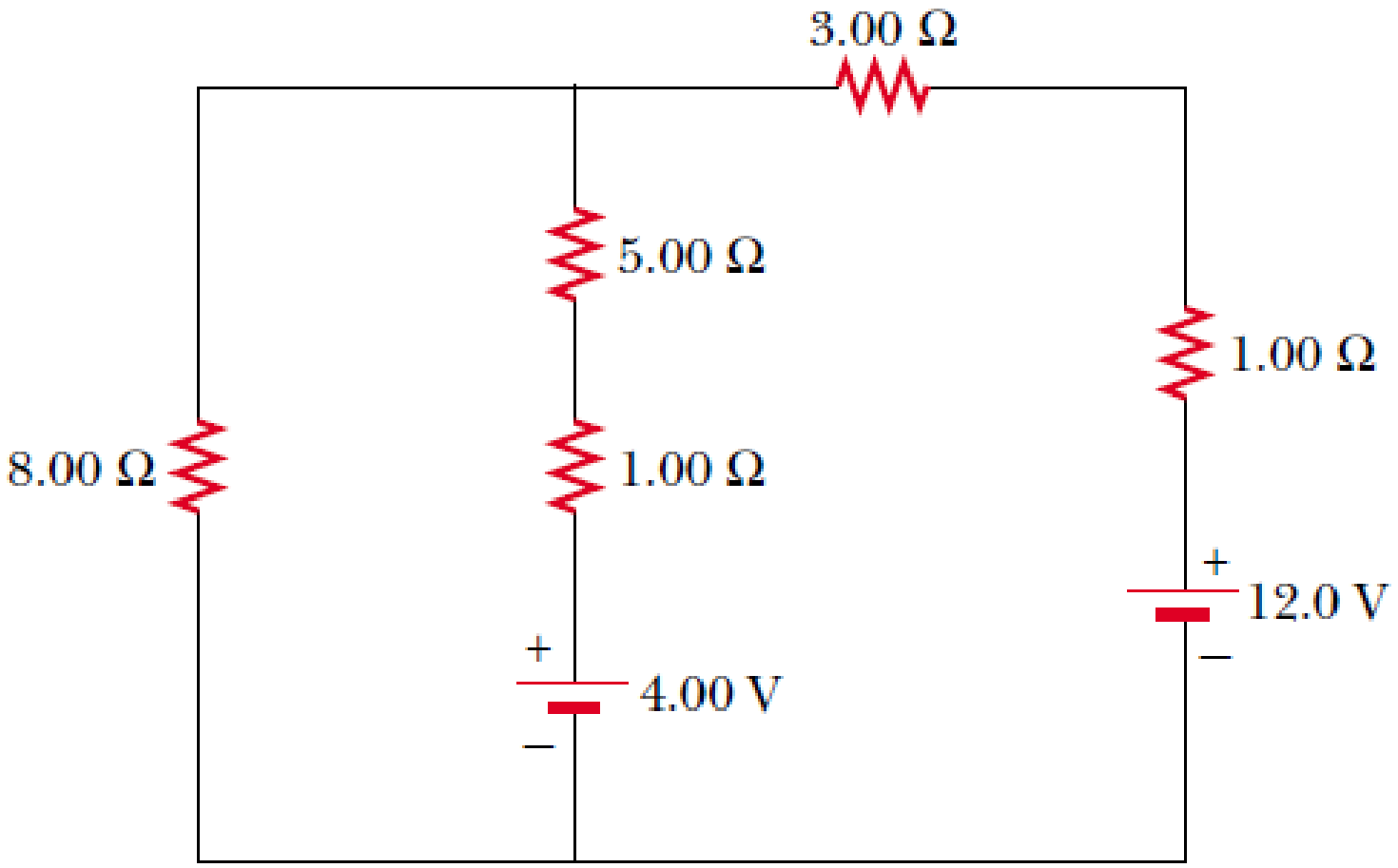


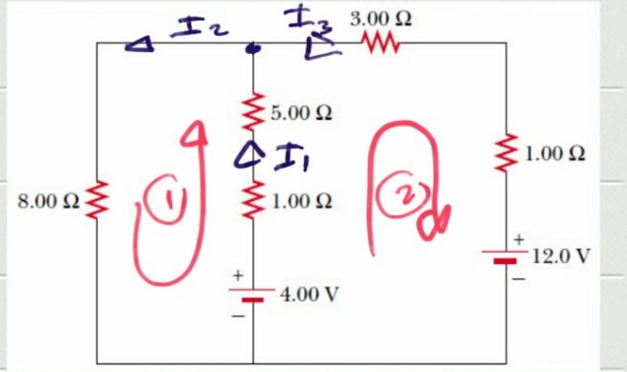
Figure P28.21 Problems 21, 22, and 23.

P.21/28:

(1) → $+4 - I_1 - 5I_1 - 8I_2 = 0$ --- (1)

(2) → $+4 - I_1 - 5I_1 - 3I_3 - I_3 - 12 = 0$ --- (2)

$\Sigma I = 0$ → $I_1 - I_2 - I_3 = 0$ --- (3)



Arrange equations:

→ $+4 \quad -6I_1 \quad -8I_2 \quad +0 \quad = 0$ (1)

$-8 \quad -6I_1 \quad +0 \quad -4I_3 \quad = 0$ (2)

$0 \quad +I_1 \quad -I_2 \quad -I_3 \quad = 0$ (3)

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(1) − (2): $12 + 0 - 8I_2 + 4I_3 = 0$ (4) (reduced: 3, 2, 1)

(1) + 6×(3): $4 + 0 - 14I_2 - 6I_3 = 0$ (5) (reduced: 2, 7, 3)

(4) → $3 + 0 - 2I_2 + I_3 = 0$ (6)

(5) → $2 + 0 - 7I_2 - 3I_3 = 0$ (7)

3×(6) + (7): $11 - 13I_2 = 0$

→ $I_2 = \frac{11}{13} = 0.846 A$ --- (8)

(8) in (6) ⇒

$3 - 2 \times \frac{11}{13} = -I_3 \rightarrow I_3 = -1.3 A$ (9)

(8) + (9) in (3):

$I_1 = 0.846 - 1.3$

$= 0.462 \quad A$

note: $I_3 = 1.3 A$ but ←

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