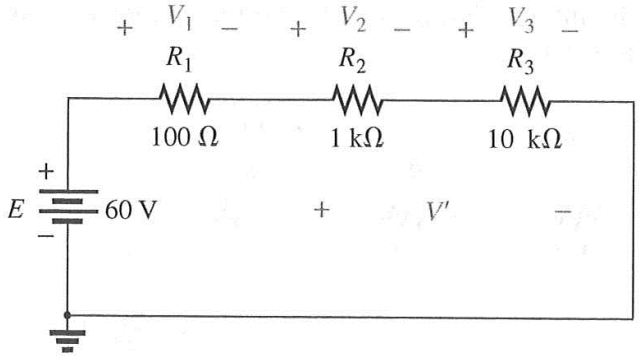
Attribution Nidhal Abdulaziz

ENGG104 Tutorial 3 Class Questions

Team Name: _____

Question 1 [common exam question]

Determine V_1,V_2,V_3 and V'. [Voltage Divider]



a.

b. V_3: $V_2 = 10\ \text{k}\Omega : 1\ \text{k}\Omega = \mathbf{10:1}$

V_3: $V_1 = 10\ \text{k}\Omega : 100\ \Omega = \mathbf{100:1}$

c. $V_3 = \dfrac{R_3 E}{R_T} = \dfrac{(10\ \text{k}\Omega)(60\ \text{V})}{0.1\ \text{k}\Omega + 1\ \text{k}\Omega + 10\ \text{k}\Omega} = \mathbf{54.05\ V}$

d. $V' = \dfrac{(R_2 + R_3)E}{R_T} = \dfrac{(1\ \text{k}\Omega + 10\ \text{k}\Omega)(60\ \text{V})}{11.1\ \text{k}\Omega} = \mathbf{59.46\ V}$

a

b

d

$V_1 = 0.54\ V$

c $V_2 = 5.41\ V$

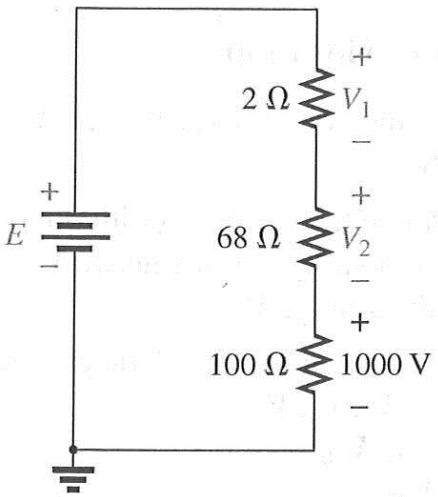
Question 2 [common exam question]

Determine V_1 and V_2

100 Ω → 1000 V

68 Ω → $\frac{1000}{100} \times 68$

2 Ω → $\frac{1000}{100} \times 2$



c. $\dfrac{1000\ \text{V}}{100\ \Omega} = \dfrac{V_2}{68\ \Omega}$, $V_2 = \dfrac{68\ \Omega(1000\ \text{V})}{100\ \Omega} = \mathbf{680\ V}$

$\dfrac{1000\ \text{V}}{100\ \Omega} = \dfrac{V_1}{2\ \Omega}$, $V_1 = \dfrac{2\ \Omega(1000\ \text{V})}{100\ \Omega} = \mathbf{20\ V}$

$E = V_1 + V_2 + 1000\ \text{V}$

$= 20\ \text{V} + 680\ \text{V} + 1000\ \text{V}$

$= \mathbf{1700\ V}$

d

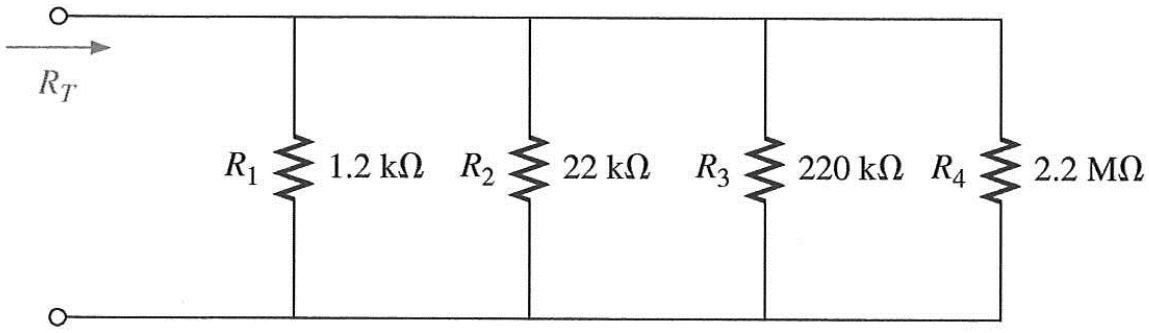
b

Question 3

Estimate the total resistance without any calculation:_____

$\frac{2\times4}{2+4} = \frac{8}{6} = \frac{4}{3}$

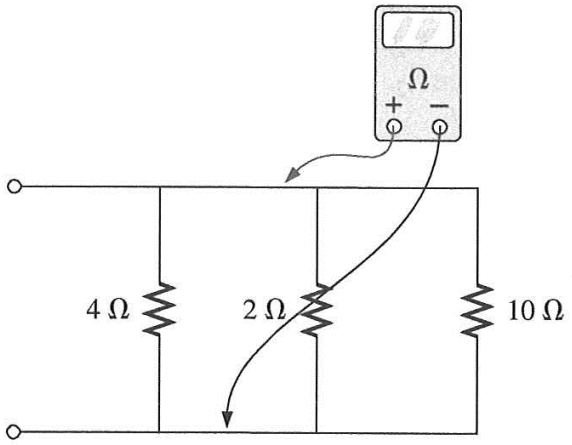
Calculate the total resistance R_T and compare :



a. 1.2 kΩ
b. about 1 kΩ
c.
$$R_T = \frac{1}{\frac{1}{1.2\,\text{k}\Omega}+\frac{1}{22\,\text{k}\Omega}+\frac{1}{220\,\text{k}\Omega}+\frac{1}{2.2\,\text{M}\Omega}}$$
$$= \frac{1}{833.333\times10^{-6}\,\text{S}+45.455\times10^{-6}\,\text{S}+4.545\times10^{-6}\,\text{S}+0.455\times10^{-6}\,\text{S}}$$
$$= \frac{1}{883.788\times10^{-6}\,\text{S}} = \mathbf{1.131\ k\Omega}$$ a

Question 4

What is the ohmmeter reading for each configuration in Fig. 77?



a.
$$R_T = \frac{1}{\frac{1}{4\,\Omega}+\frac{1}{2\,\Omega}+\frac{1}{10\,\Omega}} = \frac{1}{0.25\,\text{S}+0.50\,\text{S}+0.10\,\text{S}} = \frac{1}{0.85\,\text{S}} = \mathbf{1.18\,\Omega}$$

Question 5 [Typical exam question]

For the parallel network in Fig. 79:

a. Find the total resistance.

b. What is the voltage across each branch?

c. Determine the source current and the current through each branch.

d. Verify that the source current equals the sum of the branch currents.

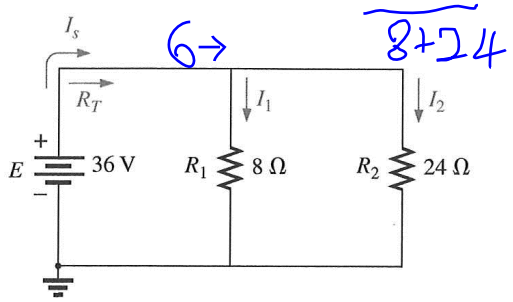


FIG. 79

9. a. $R_T = \dfrac{(8\ \Omega)(24\ \Omega)}{8\ \Omega + 24\ \Omega} = \mathbf{6\ \Omega}$

b. $V_{R_1} = V_{R_2} = \mathbf{36\ V}$

c. $I_s = \dfrac{E}{R_T} = \dfrac{36\ \text{V}}{6\ \Omega} = \mathbf{6\ A}$

$I_1 = \dfrac{V_{R_1}}{R_1} = \dfrac{36\ \text{V}}{8\ \Omega} = \mathbf{4.5\ A}$

$I_2 = \dfrac{V_{R_2}}{R_2} = \dfrac{36\ \text{V}}{24\ \Omega} = \mathbf{1.5\ A}$

d. $I_s = I_1 + I_2$

6 A = 4.5 A + 1.5 A = 6 A (checks)

Question 6 [Past exam Question]

10. For the network of Fig. 80:

a. Find the current through each branch.

b. Find the total resistance.

c. Calculate I_s using the result of part (b).

d. Find the source current using the result of part (a).

e. Compare the results of parts (c) and (d).

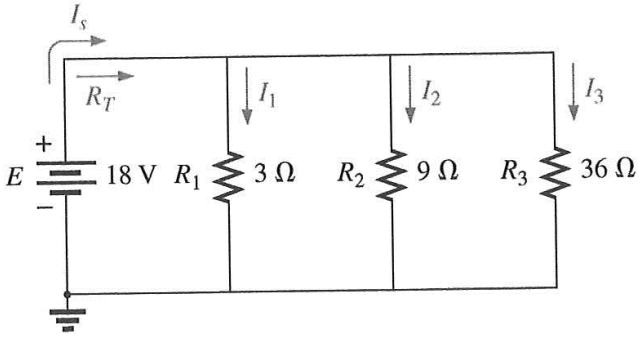


FIG. 80
Problem 10.

a b c

10. a. $I_1 = \frac{V_{R_1}}{R_1} = \frac{18\text{ V}}{3\ \Omega} = \mathbf{6\ A}$, $I_2 = \frac{V_{R_2}}{R_2} = \frac{18\text{ V}}{9\ \Omega} = \mathbf{2\ A}$, $I_3 = \frac{V_{R_3}}{R_3} = \frac{18\text{ V}}{36\ \Omega} = \mathbf{0.5\ A}$

b. $R_T = \frac{1}{\frac{1}{3\ \Omega} + \frac{1}{9\ \Omega} + \frac{1}{36\ \Omega}} = \frac{1}{0.333\text{ S} + 0.111\text{ S} + 0.028\text{ S}}$

d

$= \frac{1}{472 \times 10^{-3}\text{ S}} = \mathbf{2.12\ \Omega}$

c. $I_s = \frac{E}{R_T} = \frac{18\text{ V}}{2.12\ \Omega} = \mathbf{8.5\ A}$

e

Question 7 [current divider]

31. **a.** Determine one of the unknown currents of Fig. 100 using the current divider rule.
b. Determine the other current using Kirchhoff's current law.

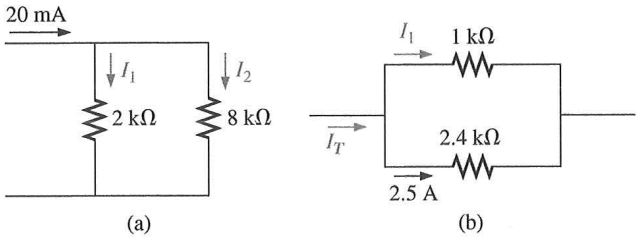


FIG. 100
Problem 31.

31. a. $I_1 = \frac{8\ \text{k}\Omega(20\text{ mA})}{2\ \text{k}\Omega + 8\ \text{k}\Omega} = \mathbf{16\ mA}$

a

$I_2 = 20\text{ mA} - 16\text{ mA} = \mathbf{4\ mA}$

b

b. $I_{2.4\text{k}\Omega} = 2.5\text{ A} = \frac{1\ \text{k}\Omega(I_T)}{1\ \text{k}\Omega + 2.4\ \text{k}\Omega} = \frac{1\ \text{k}\Omega(I_T)}{3.4\ \text{k}\Omega}$

and $I_T = \frac{3.4\ \text{k}\Omega(2.5\text{ A})}{1\ \text{k}\Omega} = \mathbf{8.5\ A}$

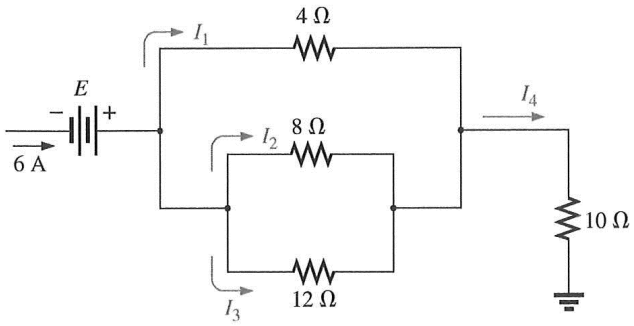
c

$I_1 = I_T - 2.5\text{ A} = 8.5\text{ A} - 2.5\text{ A} = \mathbf{6\ A}$

d

Question 8 [typical exam question]

32. For each network of Fig. 101, determine the unknown currents.



(a)

32. a. $$R_T = \frac{1}{\frac{1}{4\ \Omega} + \frac{1}{8\ \Omega} + \frac{1}{12\ \Omega}} = \frac{1}{250\times10^{-3}\text{S} + 125\times10^{-3}\text{S} + 83.333\times10^{-3}\text{S}}$$

$$= \frac{1}{458.333\times10^{-3}} = 2.18\ \Omega$$

$$I_x = \frac{R_T}{R_x} I, \qquad I_1 = \frac{2.18\ \Omega}{4\ \Omega}(6\text{ A}) = \mathbf{3.27\ A}$$

$$I_2 = \frac{2.18\ \Omega}{8\ \Omega}(6\text{ A}) = \mathbf{1.64\ A}$$

$$I_3 = \frac{2.18\ \Omega}{12\ \Omega}(6\text{ A}) = \mathbf{1.09\ A}$$

$$I_4 = \mathbf{6\ A}$$

a

b

c

d

e

Question 9 [Past exam question]

Will the breaker trip??

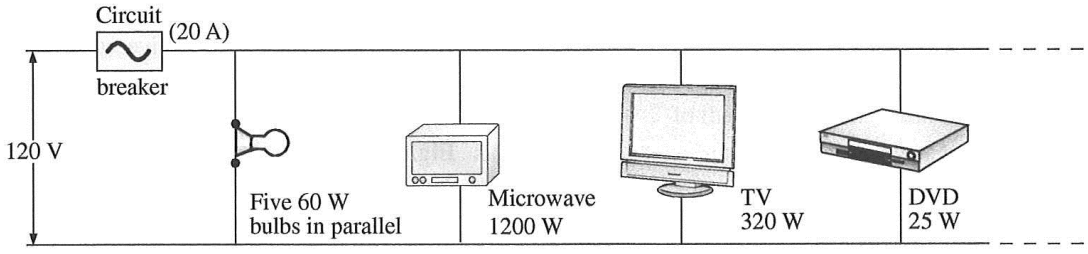


FIG. 91

$P = IV \qquad I = \frac{P}{V}$

a. $5 \times 60\ \text{W} = 300\ \text{W}$

$$I_{\text{bulbs}} = \frac{300\ \text{W}}{120\ \text{V}} = \mathbf{2.5\ A}$$ a

$$I_{\text{micro}} = \frac{1200\ \text{W}}{120\ \text{V}} = \mathbf{10\ A}$$ b

$$I_{\text{TV}} = \frac{320\ \text{W}}{120\ \text{V}} = \mathbf{2.67\ A}$$ c

$$I_{\text{DVD}} = \frac{25\ \text{W}}{120\ \text{V}} = \mathbf{208.33\ mA}$$ d

b. $I_s = \sum I = 2.5\ \text{A} + 10\ \text{A} + 2.67\ \text{A} + 208.33\ \text{mA} = \mathbf{15.38\ A}$

No