

# Elektriciteit voor dummies 1

## Oefeningen gemengdeschakeling

1. (Schema zie opgaven p36)  
Bereken alle I en U.

Geg:

U =	24 V
R1 =	100 $\Omega$
R2 =	200 $\Omega$
R3 =	300 $\Omega$

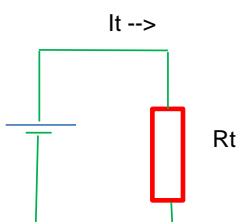
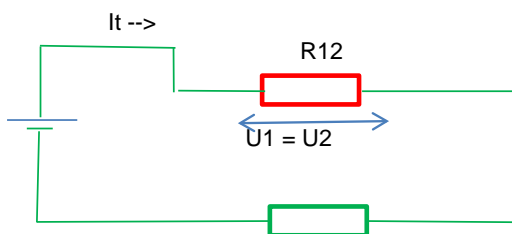
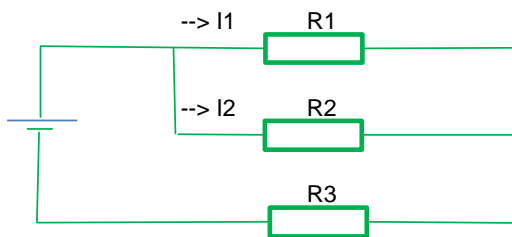
Gevr: I, I1, I2, I3, U1, U2, U3

Opl:

$$R_{12} = R1 // R2 \quad (= R_{vp})$$
$$= 100 \times 200 / (100 + 200)$$
$$= \underline{66,666667 \Omega}$$
$$R_t = R_{12} + R3$$
$$= 66,666667 + 300$$
$$= \underline{366,666667 \Omega}$$
$$I_t = U / R_t$$
$$= 24 / 366,666667$$
$$= \underline{0,06545455 \text{ A}} \quad = I3$$

$$U1 = U2 = I_t \times R_{12}$$
$$= 0,06545455 \times 66,666667$$
$$= \underline{4,363636 \text{ V}}$$
$$U3 = I_t \times R3$$
$$= 0,06545455 \times 300$$
$$= \underline{19,636364 \text{ V}}$$

$$I1 = U1 / R1$$
$$= 4,363636 / 100$$
$$= \underline{0,04363636 \text{ A}}$$
$$I2 = U1 / R2$$
$$= 4,363636 / 200$$
$$= \underline{0,02181818 \text{ A}}$$



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## Oefeningen gemengdeschakeling

2. (Schema zie opgaven p36)  
Bereken alle I en U.

Geg:

R1 =	10 Ω	R6 =	14 Ω
R2 =	25 Ω	R7 =	42 Ω
R3 =	50 Ω		
R4 =	200 Ω	U =	230 V
R5 =	20 Ω		

Gevr: I1, I2, I3, I4, I5, I6, I7, U1, U2, U3, U4, U5, U6, U7

Opl:

$$R_{23} = R_2 + R_3 = 25 + 50 = 75 \Omega$$

$$R_{234} = R_{23} // R_4 = 75 \times 200 / (75 + 200) = 54,54546 \Omega$$

$$R_{67} = R_6 // R_7 = 14 \times 42 / (14 + 42) = 10,5 \Omega$$

$$R_t = R_1 + R_{234} + R_5 + R_{67}$$

$$= 10 + 54,54546 + 20 + 10,5$$

$$= 95,04546 \Omega$$

$$I_t = U / R_t$$

$$= 230 / 95,04546$$

$$= 2,419895 \text{ A} = I_1 = I_{234} = I_5 = I_{67}$$

$$U_1 = I_t \times R_1 = 2,419895 \times 10 = 24,19895 \text{ V}$$

$$U_4 = I_t \times R_{234} = 2,419895 \times 54,54546 = 131,9943 \text{ V}$$

$$I_4 = U_4 / R_4 = 131,99426 / 200 = 0,659971 \text{ A}$$

$$I_{23} = U_4 / R_{23} = 131,99426 / 75 = 1,759923 \text{ A}$$

$$U_2 = I_{23} \times R_2 = 1,759923 \times 25 = 43,998087 \text{ V}$$

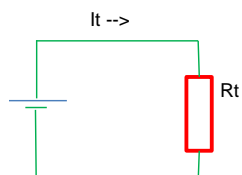
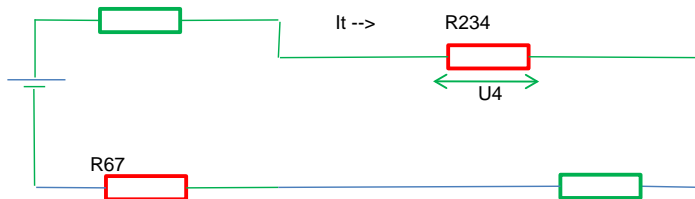
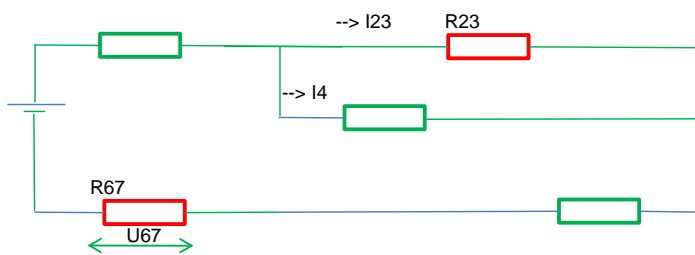
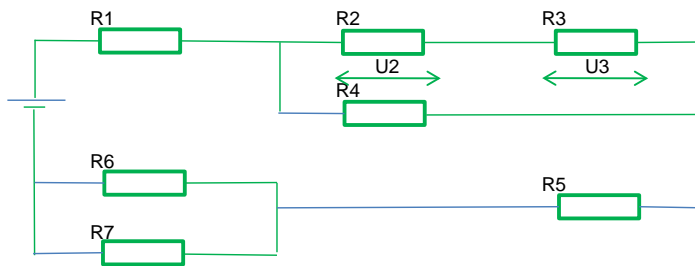
$$U_3 = I_{23} \times R_3 = 1,759923 \times 50 = 87,996174 \text{ V}$$

$$U_5 = I_t \times R_5 = 2,419895 \times 20 = 48,397896 \text{ V}$$

$$U_{67} = I_t \times R_{67} = 2,419895 \times 10,5 = 25,408895 \text{ V}$$

$$I_6 = U_{67} / R_6 = 25,408895 / 14 = 1,814921 \text{ A}$$

$$I_7 = U_{67} / R_7 = 25,408895 / 42 = 0,604974 \text{ A}$$



# Elektriciteit voor dummies 1

3. (Schema zie opgaven p36)  
Bereken alle I en U.

<u>Geg:</u>	R1 =	200 Ω	R6 =	2 Ω
	R2 =	1 Ω		
	R3 =	150 Ω		
	R4 =	5 Ω	U =	230 V
	R5 =	100 Ω		

Gevr: I1, I2, I3, I4, I5, I6, U1, U2, U3, U4, U5, U6

Opl: U1 = U = 230 V  
I1 = U / R1 = 230 / 200 = 1,15 A

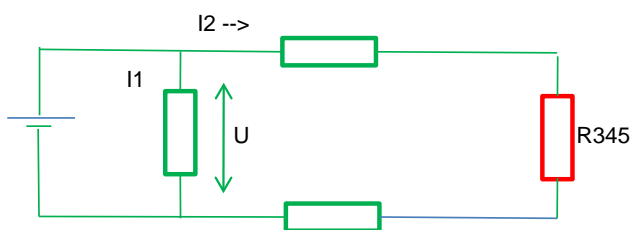
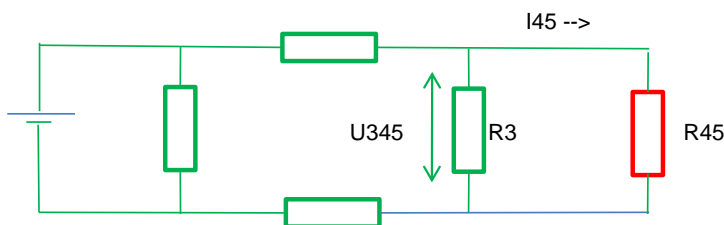
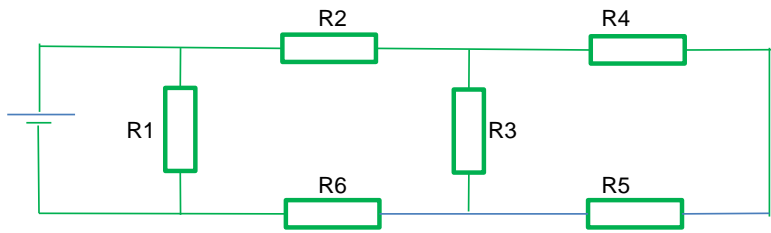
Rt = R2 + (R3 // (R4 + R5)) + R6  
= 1 + (150 // (5 + 100)) + 2  
= 1 + (150 // (105)) + 2  
= 1 + (61,764706) + 2  
= 64,76471 Ω

$R_{45} = R_4 + R_5$ $= 5 + 100$ $= 105 \Omega$
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$R_{345} = R_3 // R_{45}$ $= 1 / (1/R_3 + 1/R_{45})$ $= 1 / (1/150 + 1/105)$ $= 61,76471 \Omega$
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I2 = U / Rt = I6 = I345  
= 230 / 64,76471  
= 3,55132 A

U2 = I2 x R2 = 3,55132 x 1 = 3,55132 V  
U6 = I6 x R6 = 3,55132 x 2 = 7,10263 V  
U345 = I345 x R345 = 3,55132 x 105 = 219,34605 V  
I3 = U345 / R3 = 219,34605 / 150 = 1,46231 A  
I45 = U345 / R45 = 219,34605 / 105 = 2,08901 A  
U4 = I45 x R4 = 2,08901 x 5 = 10,44505 V  
U5 = I45 x R5 = 2,08901 x 100 = 208,901 V



4. Een bron levert 235 V aan een keten van halogeenlampen met weerstand 120 Ω. Één lamp is rechtstreeks aangesloten op de bron met een 5 m lang snoer van 1,5 mm². Hierop wordt een volgende lamp aangesloten met een zelfde snoer van 12 m en daarop nog een lamp met eenzelfde snoer van 9 m. Bereken de spanning op de lampen. Hint : teken de schakeling.

Geg:	U =	235 V	ρ =	0,0175 Ωmm²/m
	R =	120 Ω		
	L1 =	5 m		
	A =	1,5 mm²		
	L2 =	12 m		
	L3 =	9 m		

Gevr: UL1, UL2, UL3

Opl:

$$RL1 = \rho \times l / A = 0,0175 \times 2 \times 5 / 1,5 = 0,116667 \Omega$$

$$RL2 = 0,0175 \times 2 \times 12 / 1,5 = 0,280000 \Omega$$

$$RL3 = 0,0175 \times 2 \times 9 / 1,5 = 0,210000 \Omega$$

$$Rs1 = RL3 + R = 0,21 + 120 = 120,210000 \Omega$$

$$Rp3 = R // Rs1 = 1 / (1/120 + 1/120,21) = 60,052454 \Omega$$

$$Rs2 = RL2 + Rp3 = 0,28 + 60,0525 = 60,332454 \Omega$$

$$Rp2 = R // Rs2 = 1 / (1/120 + 1/60,3325) = 40,147485 \Omega$$

$$Rt = RL1 + Rp2 = 0,1167 + 40,1475 = 40,264152 \Omega$$

of -->  $Rt = RL1 + (R // (RL2 + (R // (RL3 + R))))$

$$Rt = 0,1167 + (120 // (0,28 + (120 // (0,21 + 120))))$$

$$= 0,1167 + (120 // (0,28 + (120 // (120,21))))$$

$$= 0,1167 + (120 // (0,28 + 60,0525))$$

$$= 0,1167 + (120 // 60,3325)$$

$$= 0,1167 + (40,1475)$$

$$= 40,264152 \Omega$$

$$It = U / Rt = 235 / 40,2642 = 5,836457 \text{ A}$$

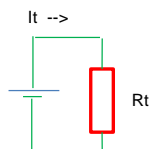
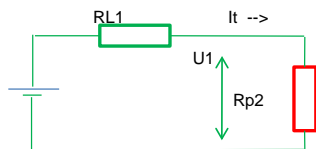
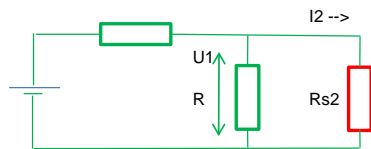
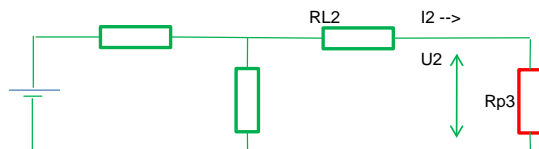
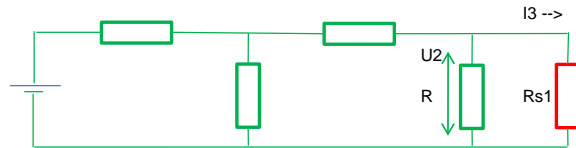
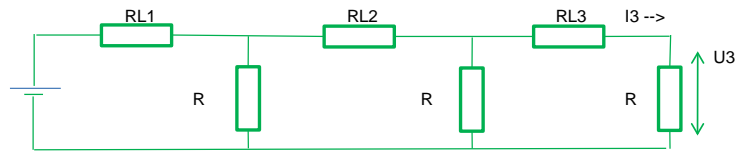
$$U1 = It \times Rp2 = 5,8365 \times 40,1475 = \underline{\underline{234,319080 \text{ V}}}$$

$$I2 = U1 / Rs2 = 234,3191 / 60,3325 = 3,883798 \text{ A}$$

$$U2 = I2 \times Rp3 = 3,8838 \times 60,0525 = \underline{\underline{234,319080 \text{ V}}}$$

$$I3 = U2 / Rs1 = 234,3191 / 120,21 = 1,949248 \text{ A}$$

$$U3 = I3 \times R = 1,9492 \times 120 = \underline{\underline{233,909738 \text{ V}}}$$



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5. Een serieschakeling van twee weerstanden (45 kΩ & 30 kΩ ) wordt aangesloten op 15 V. We meten de spanning met een voltmeter met een inwendige weerstand van 100 kΩ over de weerstand van 30 kΩ. Welke spanning gaat de meter aangeven en hoe groot is de werkelijke spanning? Hint: teken !

Geg:

R1 =	45 kΩ
R2 =	30 kΩ
U =	15 V
Rv =	100 kΩ

Gevr: Uv , Uwerkelijk

Opl: Uwerk :

$$I = U / (R1 + R2)$$
$$\rightarrow U_w = I \times R2 = U \times R2 / (R1 + R2)$$
$$= 15 \times 30 / (45 + 30)$$
$$= \underline{\underline{6 \text{ V}}}$$

Uvoltmeter:

$$R_t = R1 + (R2 // Rv)$$
$$= 45 + (30 // 100)$$
$$= 45 + (23,0769)$$
$$= 68,076923 \text{ k}\Omega$$

$$I = U_t / R_t$$
$$= 15 / 68,0769$$
$$= 0,220338983 \text{ mA}$$

$$U_v = I \times (R2 // Rv)$$
$$= 0,2203 \times (23,0769)$$
$$= \underline{\underline{5,084745763 \text{ V}}}$$

