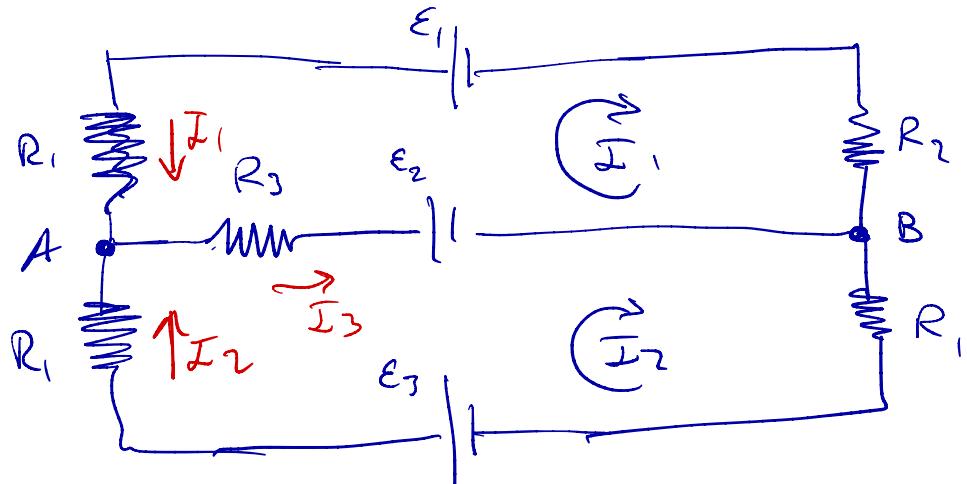


6.7



$$\epsilon_2 - \epsilon_1 = R_3 I_1 + R_1 I_1 + R_2 I_1 + 2rI_1 - R_3 I_2 - rI_2$$

$$1-7 = (1+2+3+2)I_1 - R_3 I_2 - rI_2$$

$$\epsilon_3 - \epsilon_2 = (R_1 I_2 + R_3 I_2 + R_1 I_2) + 2rI_2 - R_3 I_1 - rI_1$$

$$2-1 = (2+1+2+2)I_2 - R_3 I_1 - rI_1$$

$$\rightarrow -6 = 8I_1 - 2I_2 \quad | \quad I_2 = \frac{8I_1 + 6}{2} = 4I_1 + 3$$

$$1 = 7I_2 - 2I_1 \quad | \quad 1 = 7 \cdot 4 \cdot I_1 + 7 \cdot 3 - 2I_1 = 26I_1 + 21$$

$$I_1 = \frac{-20}{26} = -0,77$$

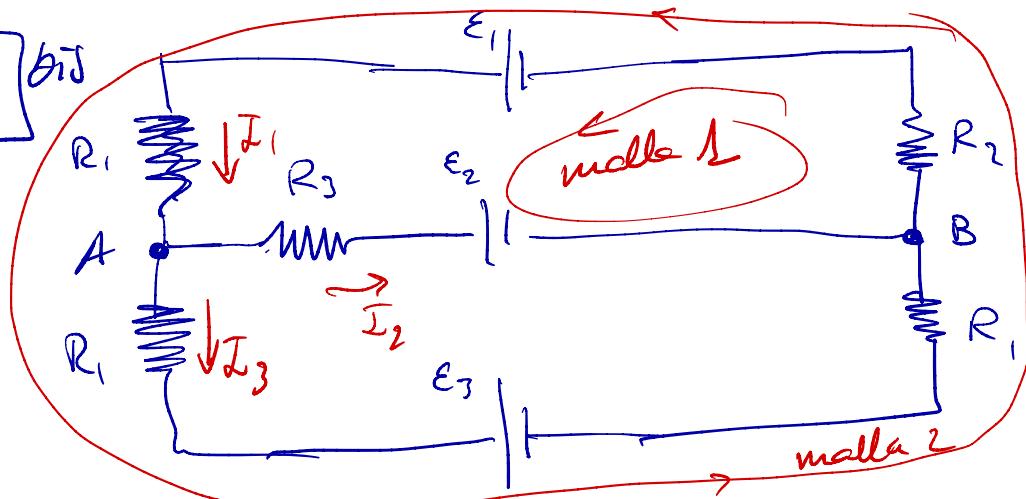
$$I_2 = -3,07 + 3 = -0,07$$

$$I_3 = I_1 + I_2 = 0,77 - 0,07 = 0,7$$

$$V_{ab} = 0,7 \cdot R_3 + 0,7 \cdot r + 1$$

6.7 b) j

V_{AB} ?



⇒ calcular I_2 , así podemos calcular V_{AB} :

$$(1) \quad I_1 = I_2 + I_3$$

$$(2) \quad E_1 - I_1 r - I_1 R_1 - I_2 R_3 - E_2 - I_2 r - I_2 R_2 = 0$$

$$(3) \quad E_1 - I_1 r - I_1 R_1 - I_3 R_1 - E_3 - I_3 r - I_3 R_1 - I_3 R_2 = 0$$

$$(2) - (3) \Rightarrow -I_2 R_3 + I_3 R_1 - E_2 + E_3 - I_2 r + I_3 r + I_3 R_1 = 0$$

↓

$$I_3 = F(I_2)$$

↓

$$I_1 = I_2 + I_3 = I_2 + F(I_2)$$

↓

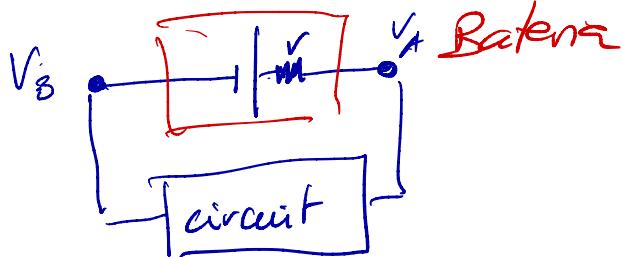
I_1 en (2) → todo en función de I_2

$$\underline{I_2 \approx 0,7 A}$$

$$V_{AB} = I_2 r + E_2 + I_2 R_3$$

$$\underline{V_{AB} = 2,38 V}$$

6.9 $E = 12V$ $r = 1\Omega$ $I = 3A$ connectada
a un circuit



a) Potència de la bateria : $P = I \cdot V = 36$ watt

b) Potència cedida al circuit

$$P = (V_A - V_B)I = (E - Ir)I$$

$$\Rightarrow P = I(E - rI) = 3(12 - 3) = 27 \text{ watt}$$

c) $W = V_{AB}Q = V_{AB}I \cdot t$ Treball fet
per la pila !!

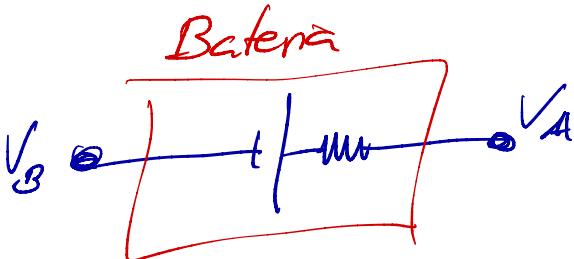
$$W = EIt = 12 \cdot 3 \cdot 5 = 180 \text{ joules}$$

d) Resistència circuit?

$$V = R \cdot I \rightarrow E = (R + r)I$$

$$12 = (R + 1)3 \rightarrow R = 3 \Omega$$

6.10



$$V_A - V_B = 11,4 \text{ V} \text{ quan } I = 20 \text{ A}$$

a) Si la bateria ideal es 12 V perdon, en donde 11,4 V quan proporciona 20 A, la resistencia interna sera:

$$V_A - V_B = E - Ir \rightarrow r = \frac{E - V_{AB}}{I}$$

$$r = \frac{12 - 11,4}{20} = 0,03 \Omega$$

b) Potencia suministrada:

$$P = EI = 12 \cdot 20 = 240 \text{ W}$$

c) Potencia proporcionada al starter:

$$P = I \underbrace{(E - rI)}_{V_A - V_B} = 20(12 - 0,03 \cdot 20) \approx 228 \text{ W}$$

d) $P = \frac{W}{\Delta t} \rightarrow W = \underbrace{EI \Delta t}_{P_{bateria}} = 240 \cdot 7 = 168 \text{ joules}$

e) Potencia disipada por la resistencia:

$$P_{diss} = rI^2 \cdot \Delta t = 0,03 \cdot 20^2 \cdot 7 \approx 84 \text{ joules}$$

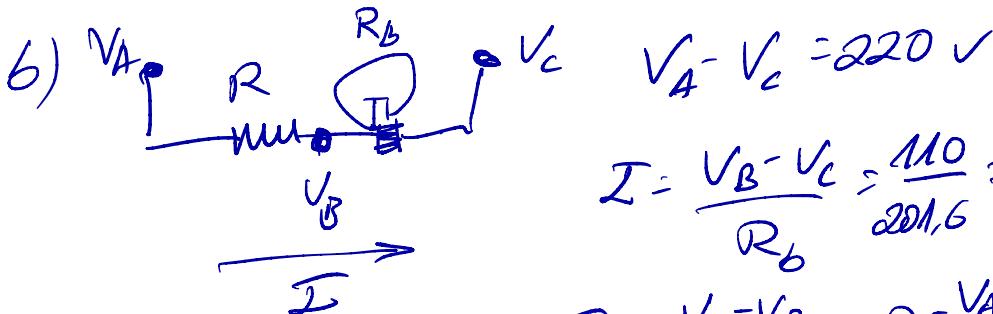
6.11 Bombeta dura 60 watt quan $V=110\text{ V}$

a) Primer cal calcular la resistència.

Aquesta resistència no canvia amb el V

$$P = \frac{V^2}{R} \rightarrow R = \frac{V^2}{P} = \frac{110^2}{60} = 201,6\text{ S}\Omega$$

$$\text{A } 220\text{ V} \rightarrow P' = \frac{220^2}{201,6\text{ S}\Omega} \approx 240\text{ W}$$



$$I = \frac{V_B - V_C}{R_B} = \frac{110}{201,6} = 0,54\text{ A}$$

$$I = \frac{V_A - V_B}{R} \rightarrow R = \frac{V_A - V_B}{I}$$

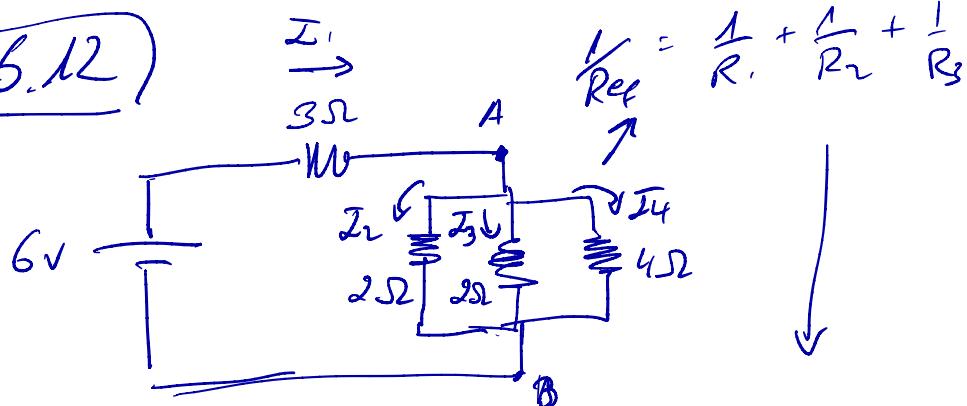
$$R \approx 202\text{ S}\Omega$$

c) Potència total $\rightarrow R_T = R + R_B \approx 2R$

$$P = \frac{V^2}{R} \approx \frac{220}{2 \cdot 202} = 120\text{ W}$$

d) $W = V \cdot I \cdot \Delta t = P \cdot t = 120 \cdot 24 \approx 2,9\text{ kWh}$

(6.12)



$$\frac{1}{R_{\text{Ref}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$R_{\text{Ref}}' = \frac{R_1 \cdot R_2 \cdot R_3}{(R_1 \cdot R_3) + (R_1 \cdot R_2) + (R_2 \cdot R_3)} = \frac{2 \cdot 2 \cdot 4}{(2 \cdot 4) + (2 \cdot 4) + (2 \cdot 2)} = \frac{16}{20} = 0.8 \Omega$$

$$R_{\text{Ref}}' = \frac{4}{5} = 0.8 \Omega$$

$$R_{\text{Ref}}' = 0.8 + 3 = 3.8 \Omega \quad | \quad I = 2I' + I_3$$

$$I_1 = I = \frac{6}{3.8} \approx 1.6 \text{ A} \quad | \quad E = V(3\Omega) + V(R_{\text{ref}}')$$

$$V(3\Omega) = I \cdot R = 1.6 \cdot 3 = 4.8 \text{ V} \quad | \quad 4.71 \text{ V}$$

$$V(R_{\text{ref}}') = 1.2 \text{ V} \quad | \quad 1.29 \text{ V}$$

$$I_2 = I_3 = \frac{1.2}{2} = 0.6 \text{ A}$$

$$I_4 = I - 2I_2 = 1.6 - 1.2 = 0.4 \text{ A}$$

$$\boxed{6.12} \quad P = I V = 1,6 A \cdot 6 V \approx 9,7 W$$

$$E(3\Omega) = r I^2 = 3 \cdot (1,6)^2 \approx 7,7 \text{ Joule}$$

$$E(4\Omega) = r I^2 = 4 \cdot (0,4)^2 = 0,64 \text{ Joule}$$

$$E(2\Omega) \approx 0,7 \text{ Joule}$$