

LASKU U_{AB}

$V_A = 10V$
A

$V_B = 4V$
B

JÄNNITE POTENTIAALIN ERO
 $U_{AB} = V_A - V_B$
 $= 10V - 4V = 6V$

12V
A

7V
B

$U_{AB} =$

7V
A

12V
B

$U_{AB} = V_A - V_B =$

5V
A

3V
B

$U_{AB} =$

$U_{BA} =$

-4V
A

-7V
B

$U_{AB} =$

28V
A

-9V
B

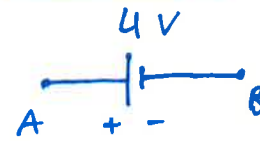
$U_{AB} =$

-13V
A

-12V
B

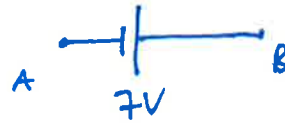
$U_{AB} =$

LASKU U_{AB}

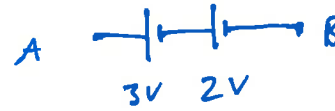


KOSKA A ON (+)-PUOLELLA,
NIIN

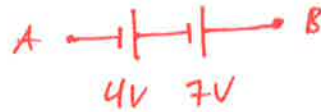
$U_{AB} = 4V$



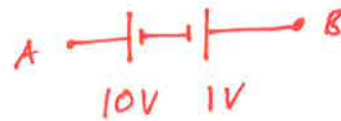
$U_{AB} = -7V$



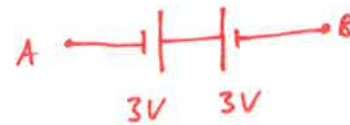
$U_{AB} = 5V$



$U_{AB} =$



$U_{AB} =$



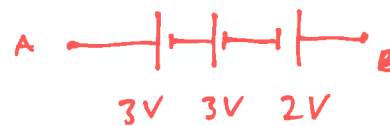
$U_{AB} =$



$U_{AB} =$



$U_{AB} =$



$U_{AB} =$

LASKE U_{AB}

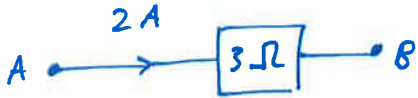
JÄNNITÄHÄVIÖ $U = RI$
VASTUKSESSA



KOSKA VIRTA ON $A \rightarrow B$,
TÄYTYY OLLA $V_A > V_B$

$\Rightarrow U_{AB} = V_A - V_B > 0$

SIIIS $U_{AB} = +RI$



$U_{AB} = 3\Omega \cdot 2A = 6V$

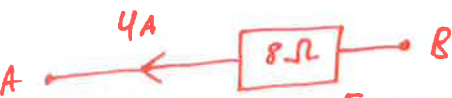


$U_{AB} = -4 \cdot 3 = -12$

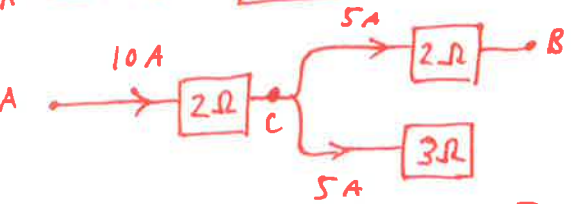
A → B VIRTA VASTAAN



$U_{AB} =$



$U_{AB} =$



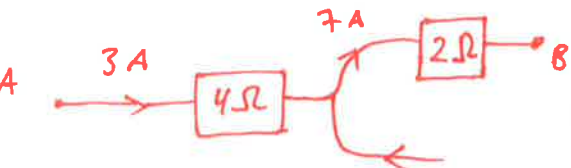
$U_{AC} =$

$U_{CB} =$

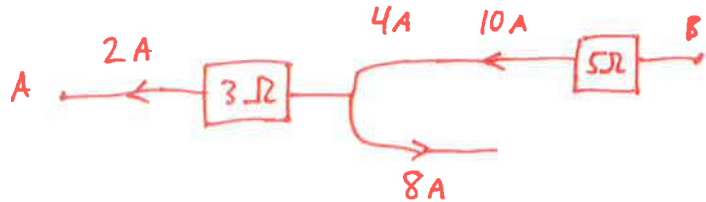
$U_{AB} = U_{AC} + U_{CB}$

\Rightarrow

$=$

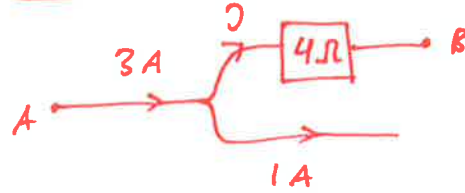


$U_{AB} =$

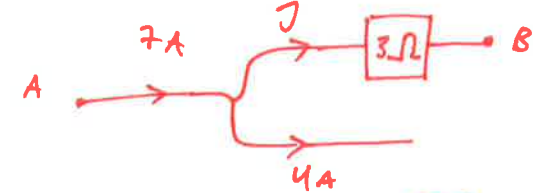


$U_{AB} =$

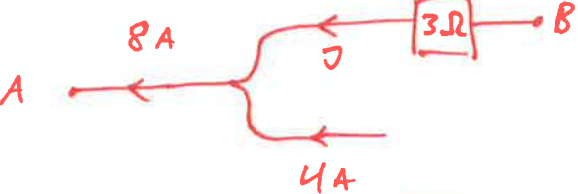
LASKE I JA U_{AB}



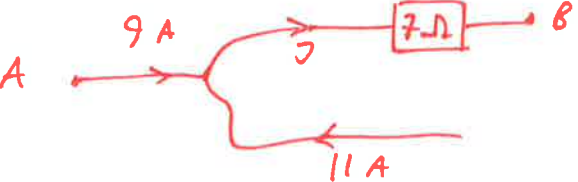
$I =$
 $U_{AB} =$



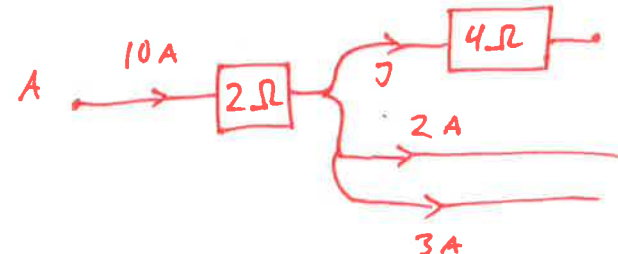
$I =$
 $U_{AB} =$



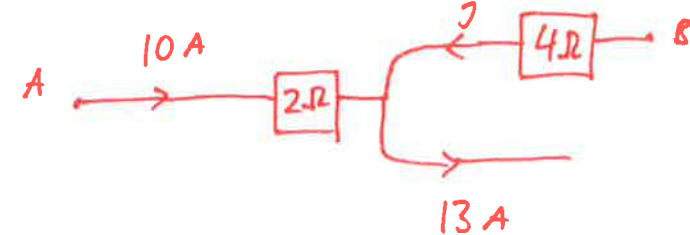
$I =$
 $U_{AB} =$



$I =$
 $U_{AB} =$

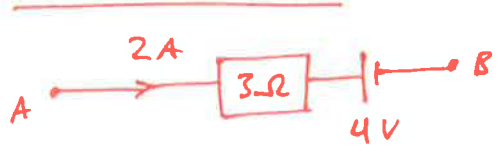


$I =$
 $U_{AB} =$



$I =$
 $U_{AB} =$

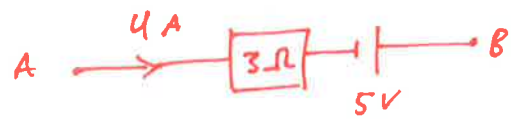
LASKU U_{AB}



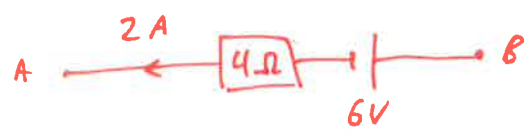
$U_{AB} =$



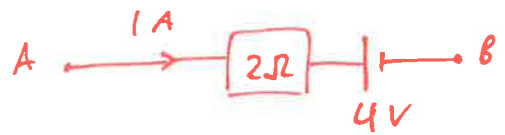
$U_{AB} =$



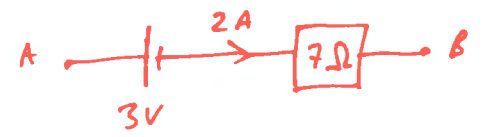
$U_{AB} =$



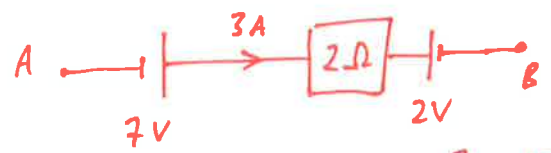
$U_{AB} =$



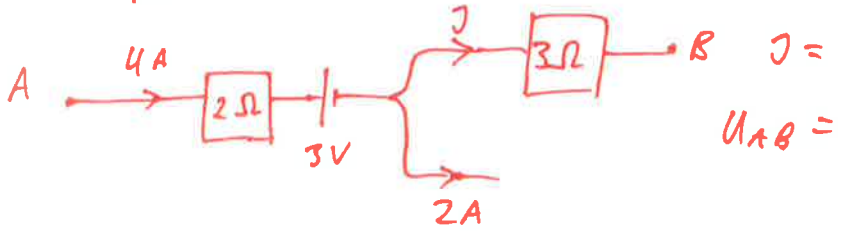
$U_{AB} =$



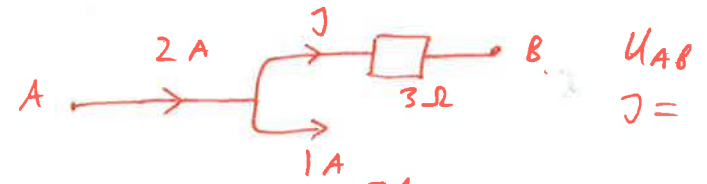
$U_{AB} =$



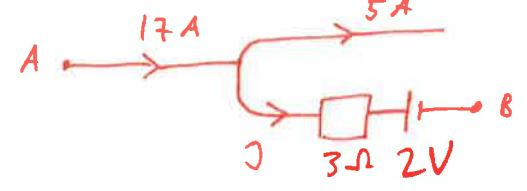
$U_{AB} =$



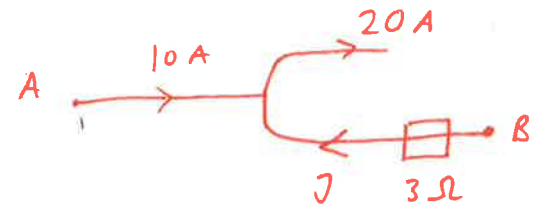
$J =$
 $U_{AB} =$



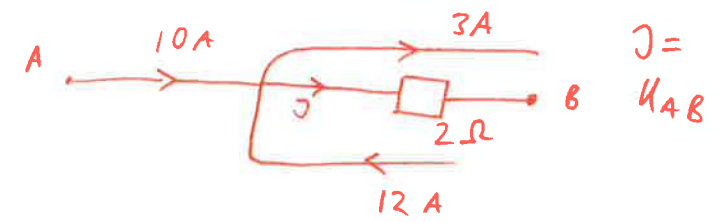
U_{AB}
 $J =$



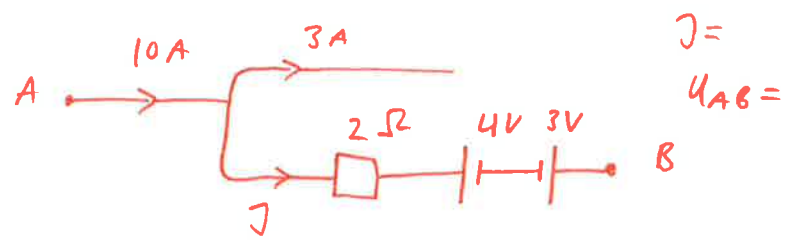
$J =$
 U_{AB}



$J =$
 $U_{AB} =$

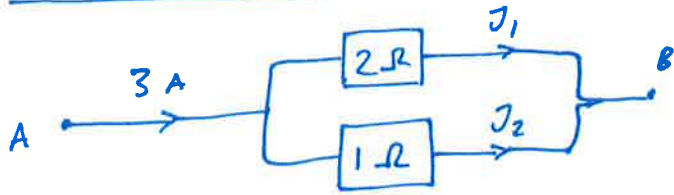


$J =$
 U_{AB}



$J =$
 $U_{AB} =$

VIRTOJEN JAKAUTUMINEN



KOSKA 1Ω VASTUS ON PIENEMPI, NIIN SEN KAUTTA KULKEE SUUREMPI VIRTA
 $\Rightarrow J_2 > J_1$

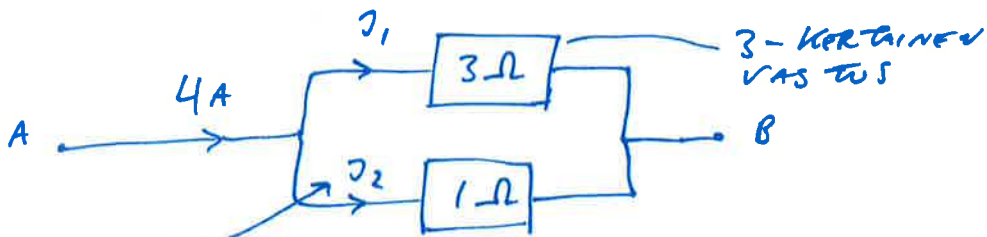
JÄNNITEHÄVIÖT VASTUKSISSA OVA T SAMAT

$$\Rightarrow U_{AB} = 2\Omega \cdot J_1 = 1\Omega \cdot J_2$$

$$\text{SIIS } J_1 = 1A \text{ JA } J_2 = 2A$$

$$\Rightarrow J_1 + J_2 = 1 + 2 = 3A \quad \text{OK}$$

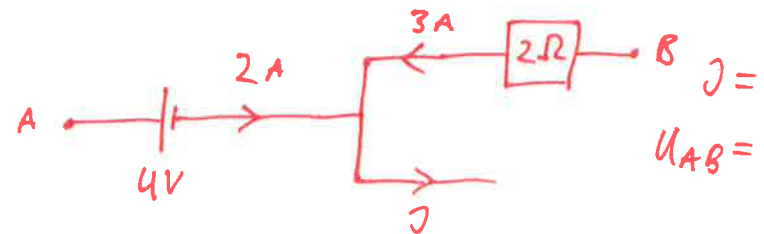
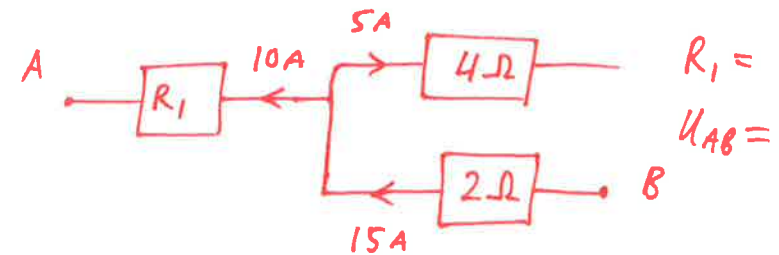
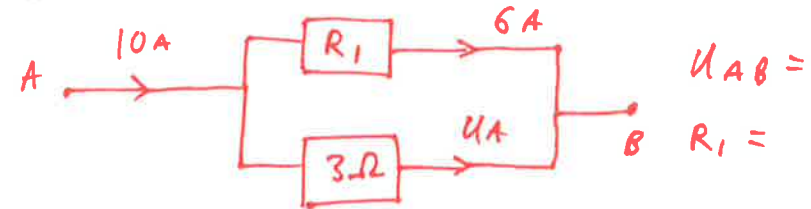
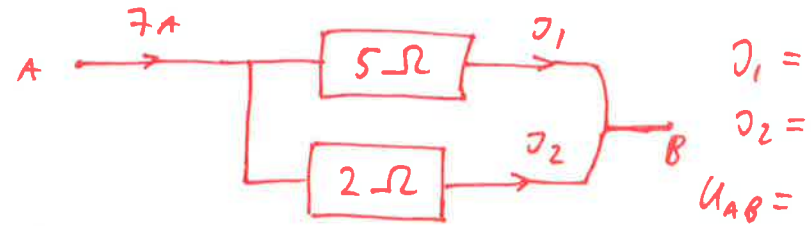
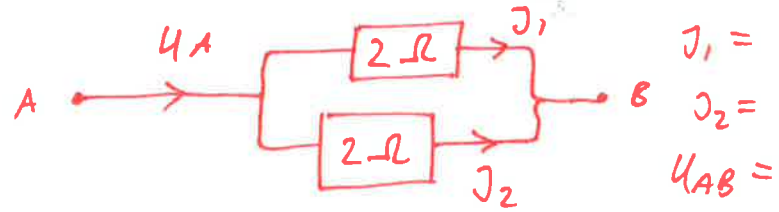
VIRTA ET HÄVIÄ:



SIIS 3-KERTAINEN VIRTA $\Rightarrow J_1 = 1A \text{ \& } J_2 = 3A$

$$1 + 3 = 4 \quad \text{OK}$$

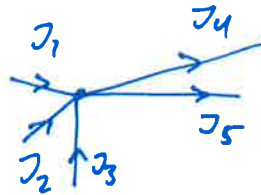
LASKI VIRRAT JA U_{AB}



KIRCHOFFIN LAIT

K1

VIRTA EI HÄVIÄ/
SYNNY TYHJÄSTÄ



$$I_1 + I_2 + I_3 = I_4 + I_5$$

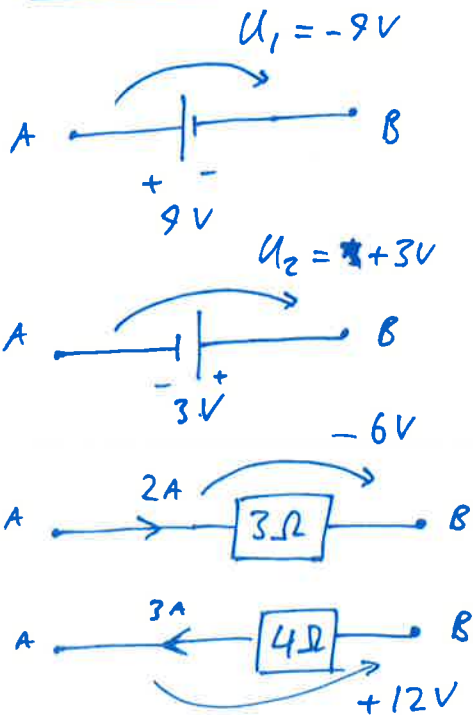
TULEVAT LÄHTEVÄT

K2

SULJETUSSA
SILMUKASSA

$$U_1 + U_2 + \dots + U_N = 0$$

LASKUSÄÄNNÖT

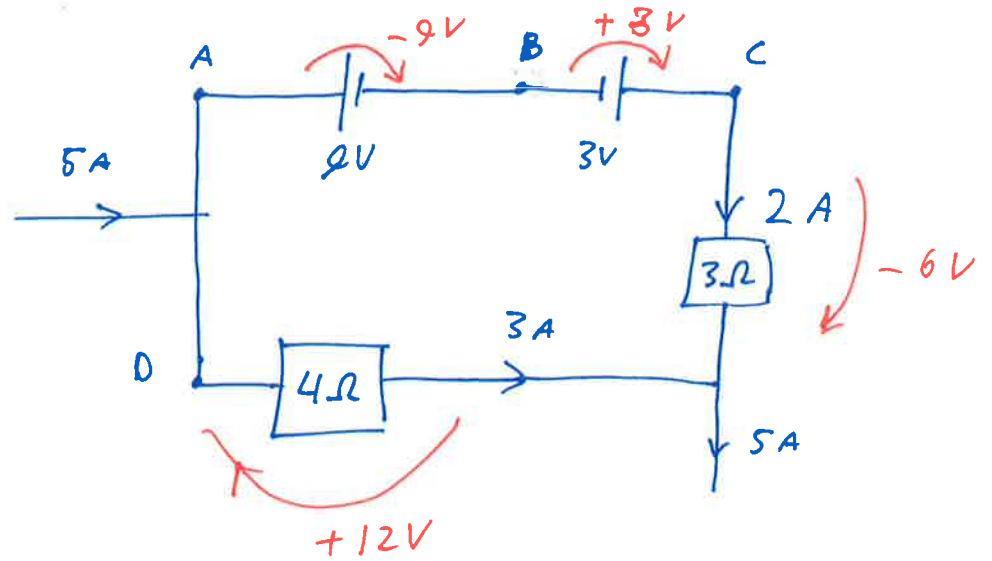


HYPÄTÄÄN 9V
PIENEMMÄÄN
POTENTIAALIIN

HYPÄTÄÄN 3V
KORKEAMPAAN
POTENTIAALIIN

POT. PIENENEÄ

POT. KASKAA



$$\underbrace{-9V + 3V}_{-6V} + \underbrace{-6V + 12V}_{+6V} = 0V$$

KIERROKSELLE ABCD

VIRTAPIIRI LASKUSSA TULEE USETIN YHTÄLÖRYHMIÄ, ESIM.

$$\begin{cases} J_1 + 2J_2 + J_3 = 4 \\ 2J_1 - J_2 + 3J_3 = 5 \\ 4J_1 - 2J_2 + 7J_3 = 0 \end{cases}$$

NÄITÄ VOI RATKOA NETISSÄ, ESIM. GOOGLETA

"EQUATION GROUP SOLVER"

→ WOLFRAM ALPHA

→ SYÖTÄ YHTÄLÖT

$$a + 2b + c = 4$$

$$2a - b + 3c = 5$$

$$4a - 2b + 7c = 0$$

→

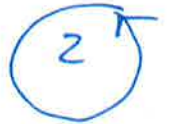
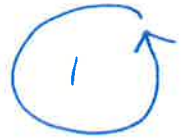
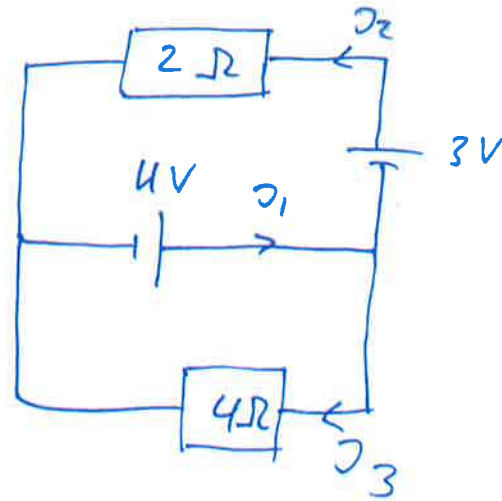
$$\begin{aligned} a &= \frac{84}{5} = J_1 \\ b &= -\frac{7}{5} = J_2 \\ c &= -10 = J_3 \end{aligned}$$

PAINA → SUBMIT

VOI KÄYDÄ NIIN, ETÄ TULEE MIINUS MERKKEJÄ

(ÄLÄ ~~...~~ SEKOA KUVISSA)

ESIM. RATKAISTUAN VIRRAT



k1 $J_1 = J_2 + J_3$

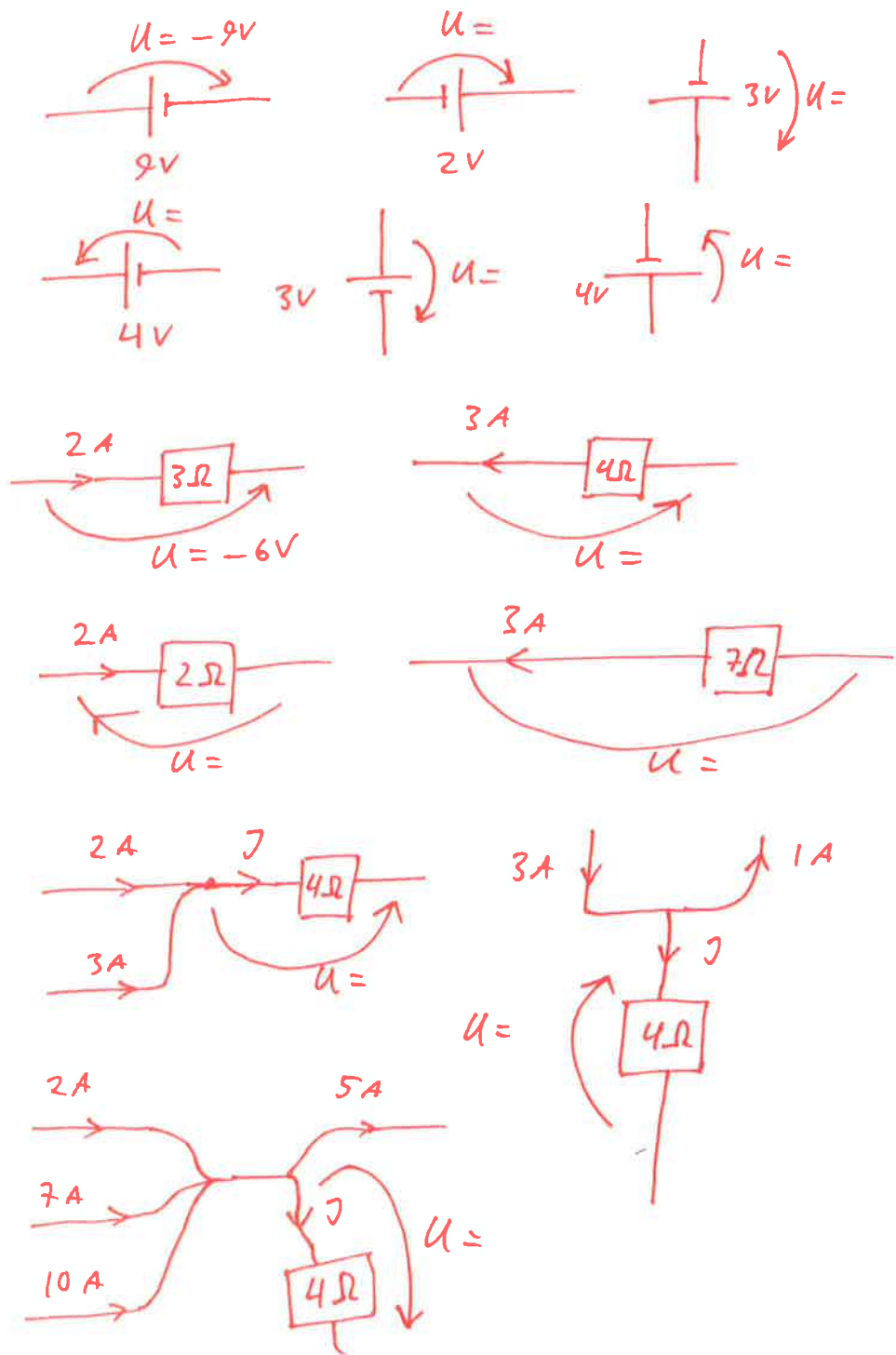
① → $4 + 3 - 2J_2 = 0$

② → $4 - 4J_3 = 0$

→
$$\begin{cases} J_1 - J_2 - J_3 = 0 \\ \quad \cdot 2J_2 = 7 \\ \quad \quad \quad 4J_3 = 4 \end{cases} \Rightarrow J_2 = \underline{\underline{\frac{7}{2} A}} \\ \Rightarrow J_3 = \underline{\underline{1 A}}$$

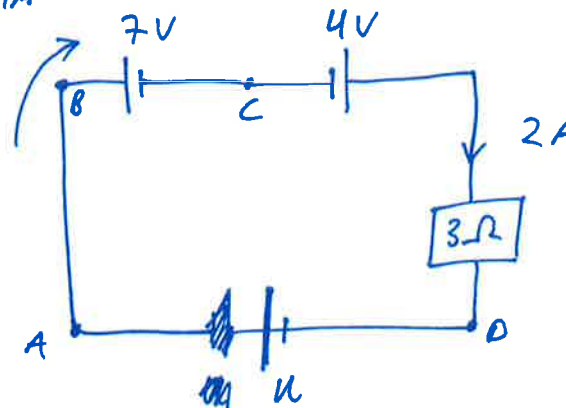
→ $J_1 = J_2 + J_3 = 1 + \frac{7}{2} = \underline{\underline{\frac{9}{2} A}}$

MERKKAA POTENTIAALI MUUTOKSET



KOSKA $U_1 + U_2 + \dots + U_N = 0$, NIIN VOIDAAN LASKEA TUNTEMATTOMIA VIRTOJA JA JÄNNITTEITÄ JA VASTUKSIA

ESIM.

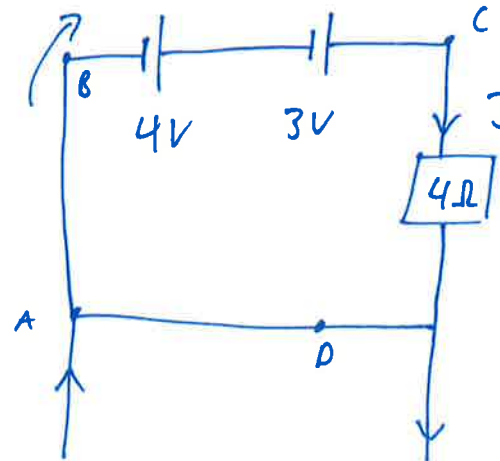


KIERRIS ABCD

$$\begin{aligned}
 0 &= -7V + 4V - 2 \cdot 3V + U \\
 &= -3V - 6V + U \\
 &= -9V + U
 \end{aligned}$$

$$\leadsto 0 = -9V + U \rightarrow \underline{\underline{U = 9V}}$$

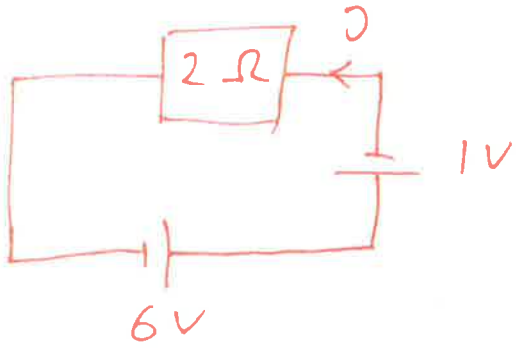
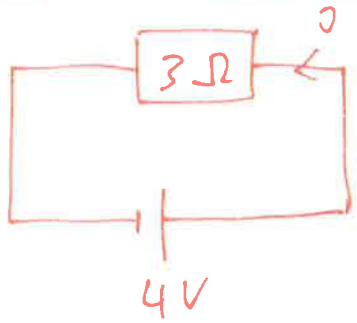
ESIM.



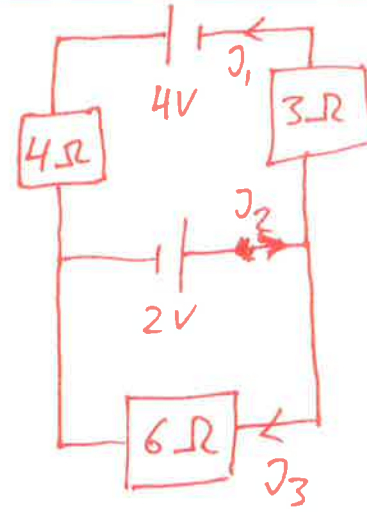
$$\begin{aligned}
 0 &= +4 \\
 &+ 3 \\
 &- 4J \\
 &= 7 - 4J
 \end{aligned}$$

$$\leadsto J = \underline{\underline{\frac{7}{4} A}}$$

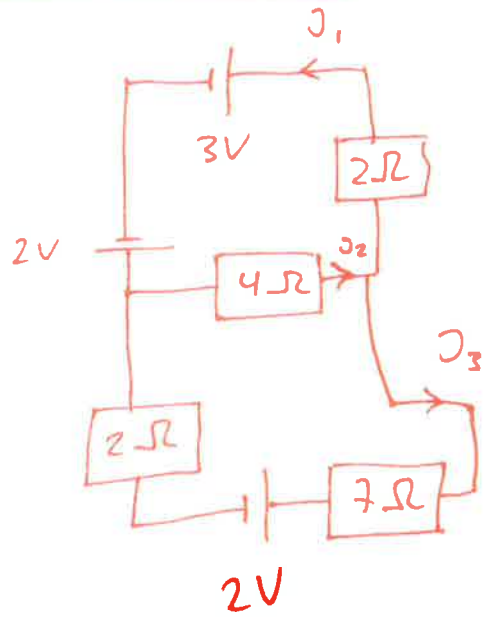
RATKAISE VIRRAT



RATKAISE VIRRAT



RATNAISE VIRRAT



RATNAISE VIRRAT

