

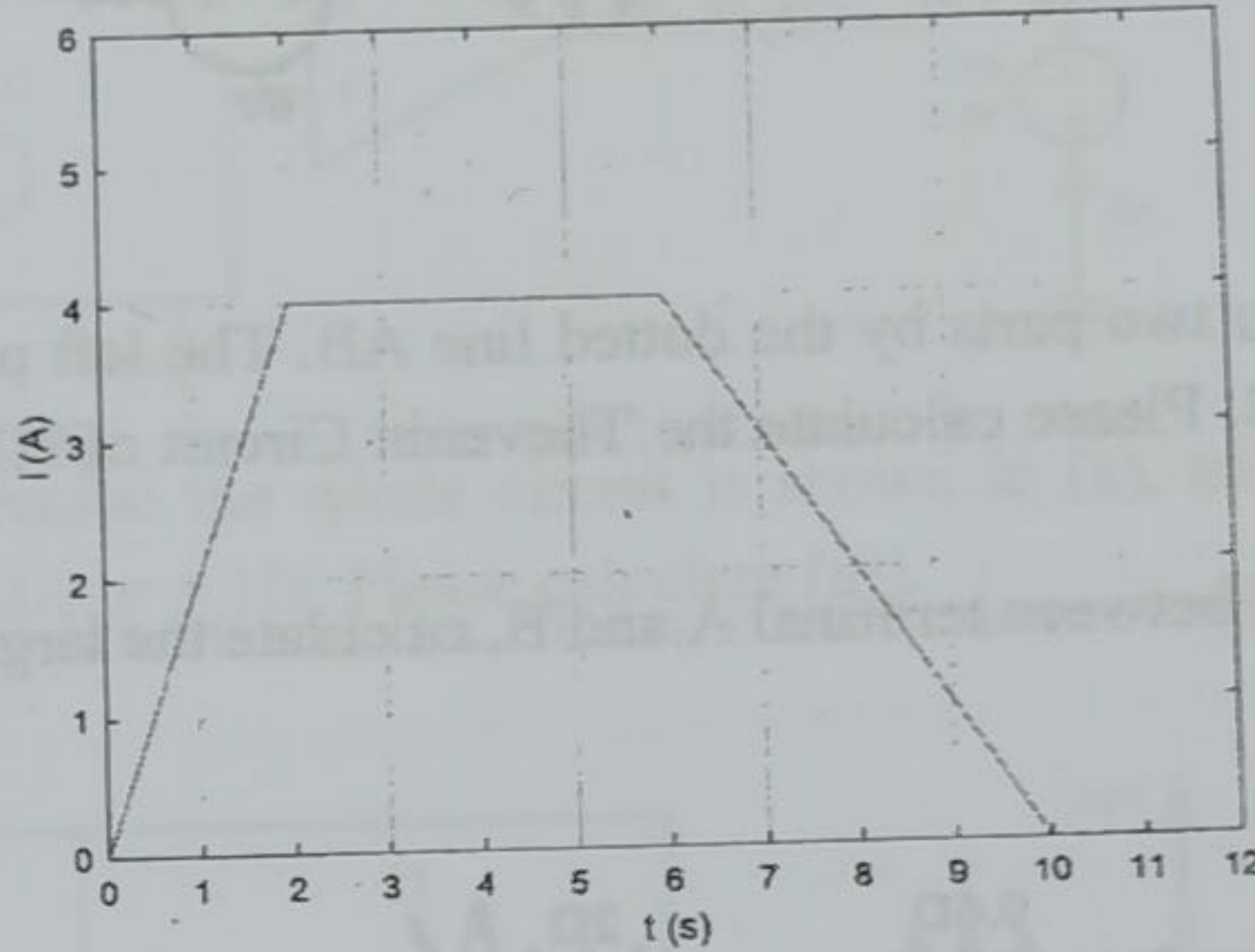
Fundamentals of Electric Circuits Midterm Exam (Fall 2021)

Date: 2021.11.20

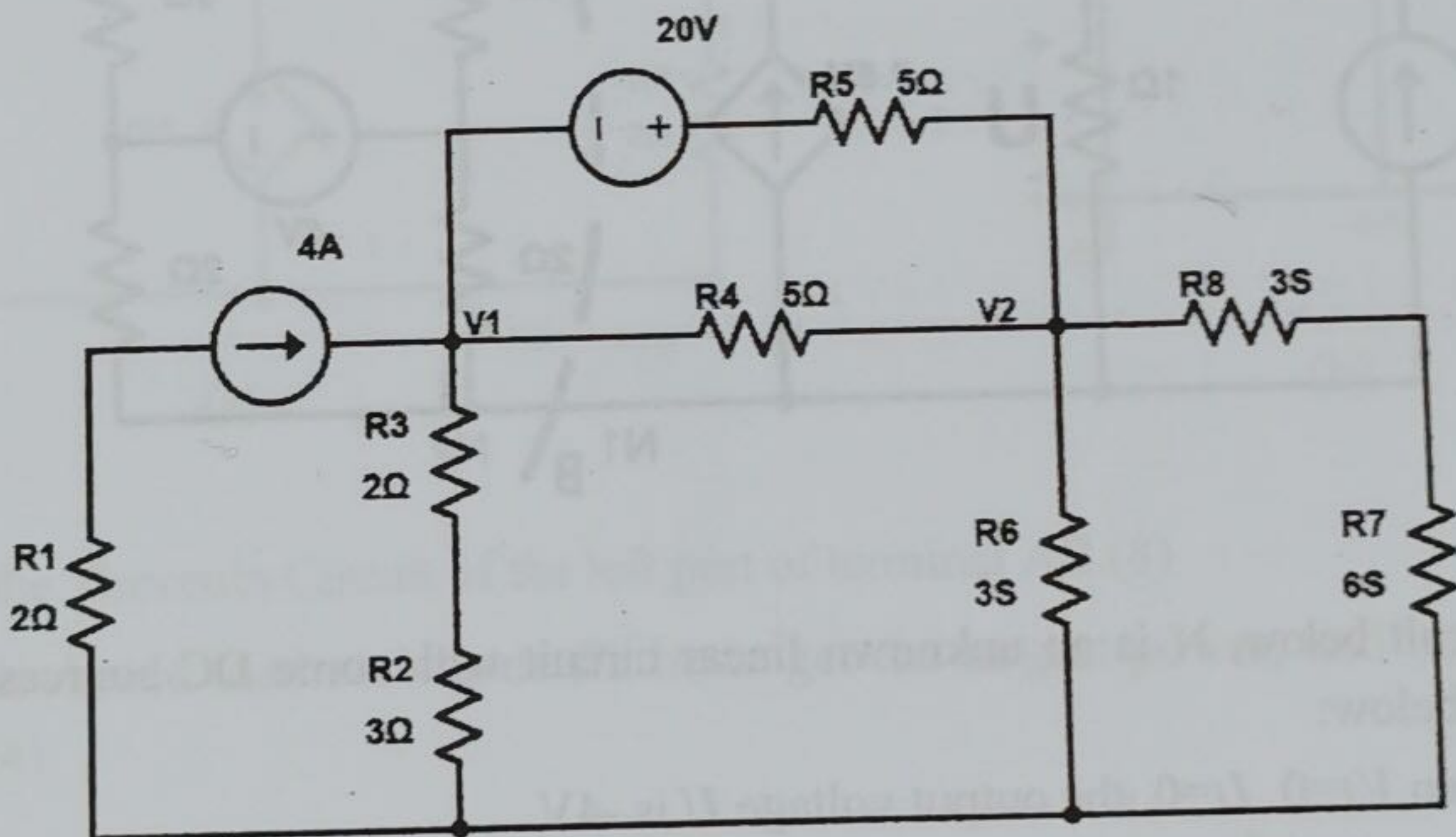
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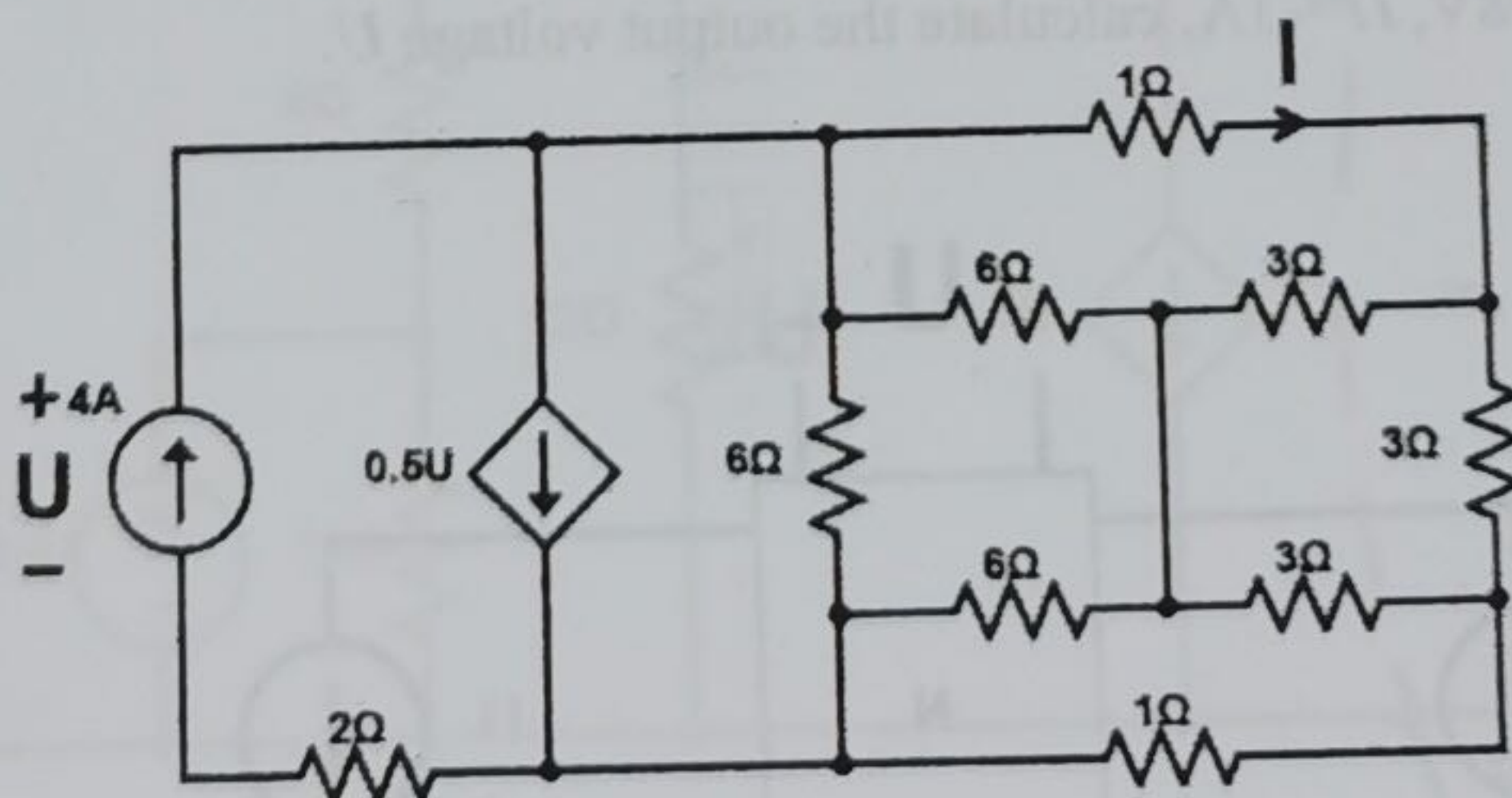
1. (10) The current flowing past an element is shown in Fig. The voltage across the element is 3V.
- Calculate the total charge through the element.
 - Find the energy delivered to the element.



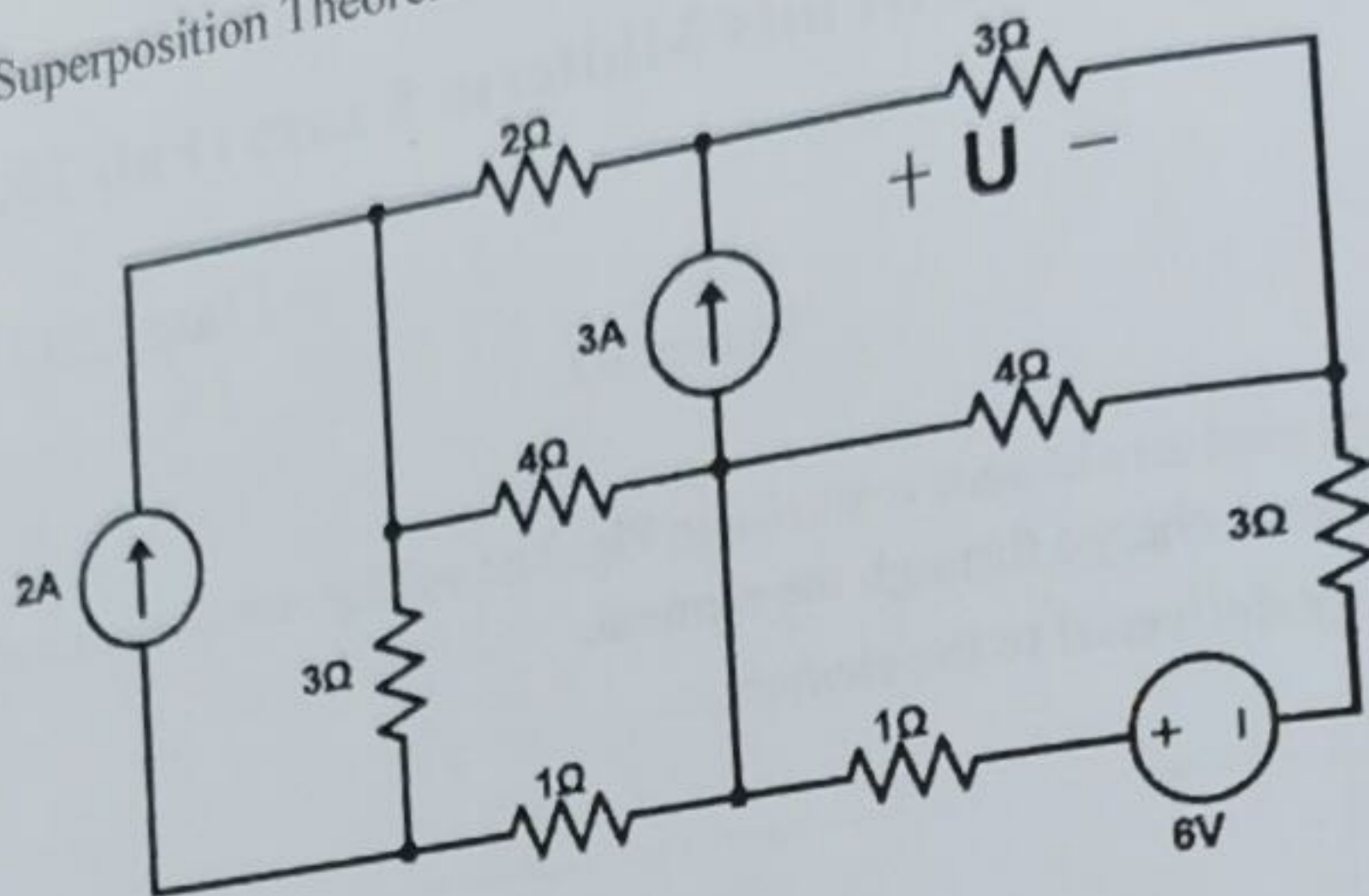
2. (10) For the circuit shown in Fig. Find the node voltage V_1 and V_2 .



3. (10) Calculate the current I and the voltage U .

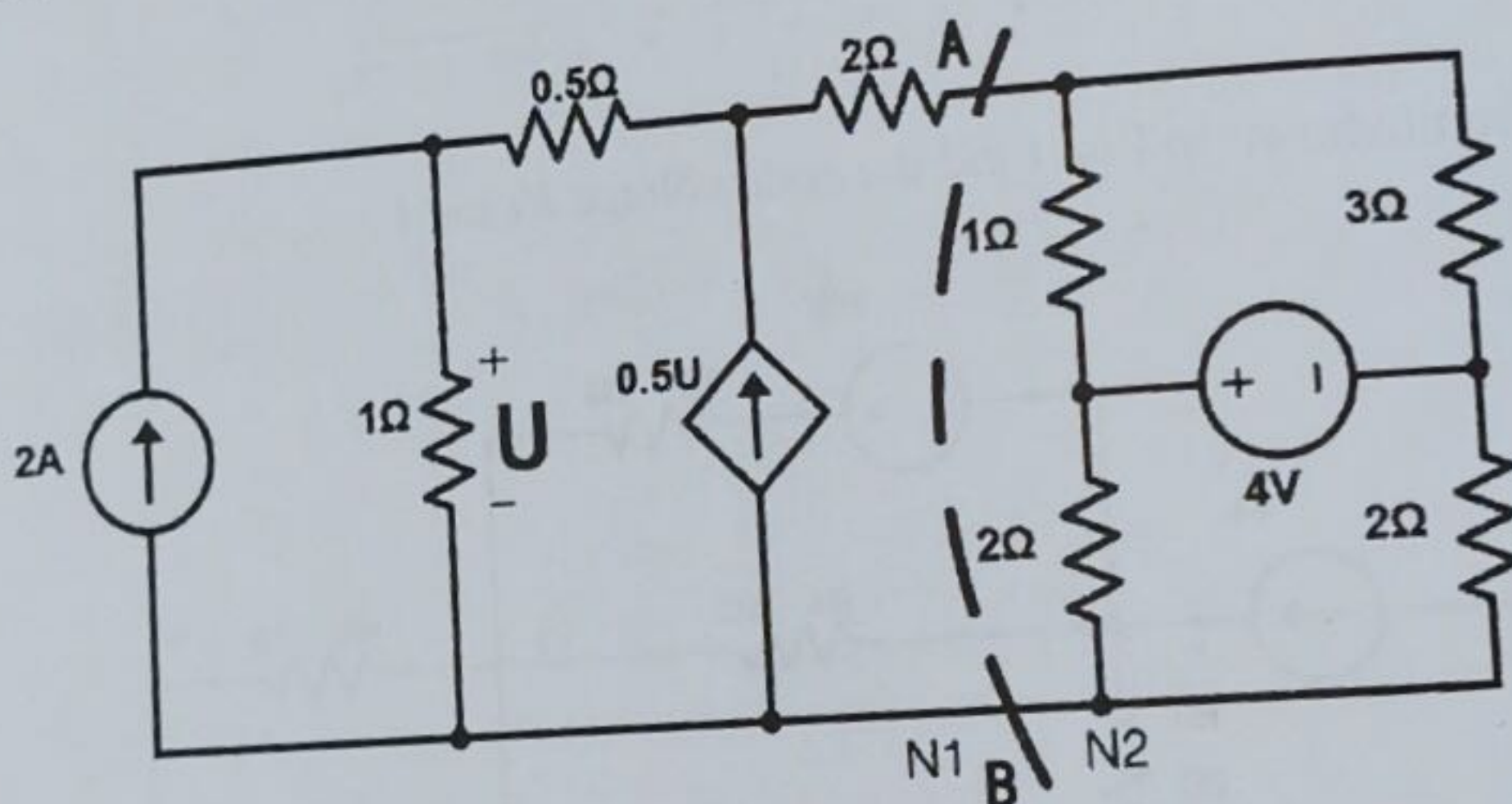


4. (10) Use Superposition Theorem to calculate U .



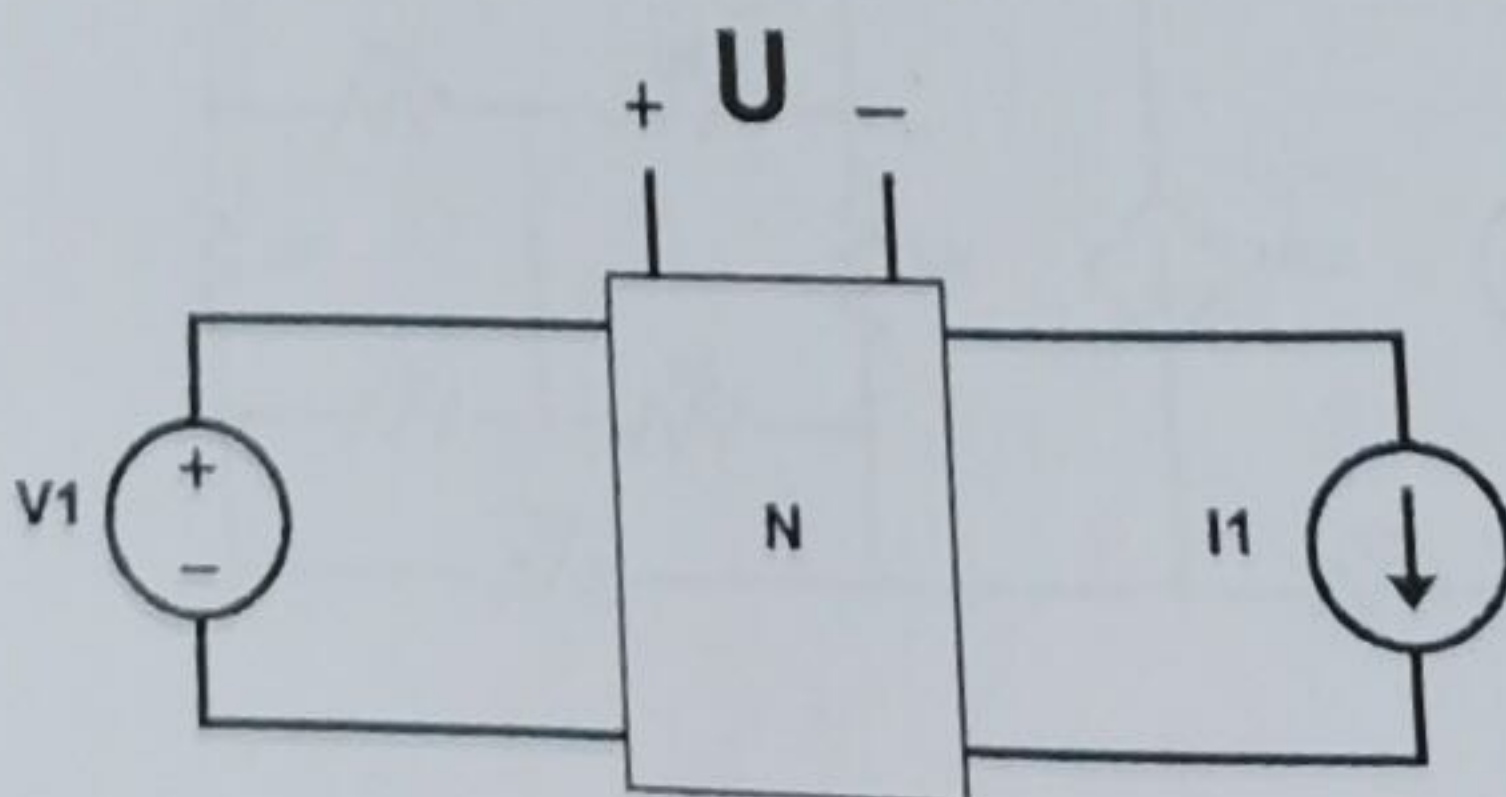
5. (13)

- The circuit is divided into two parts by the dotted line AB. The left part is called N1, and the right part is called N2. Please calculate the Thevenin Circuit of N1 and N2 at terminal AB respectively. (8)
- If a resistance R_L is added between terminal A and B, calculate the largest power R_L can get and R_L . (5)

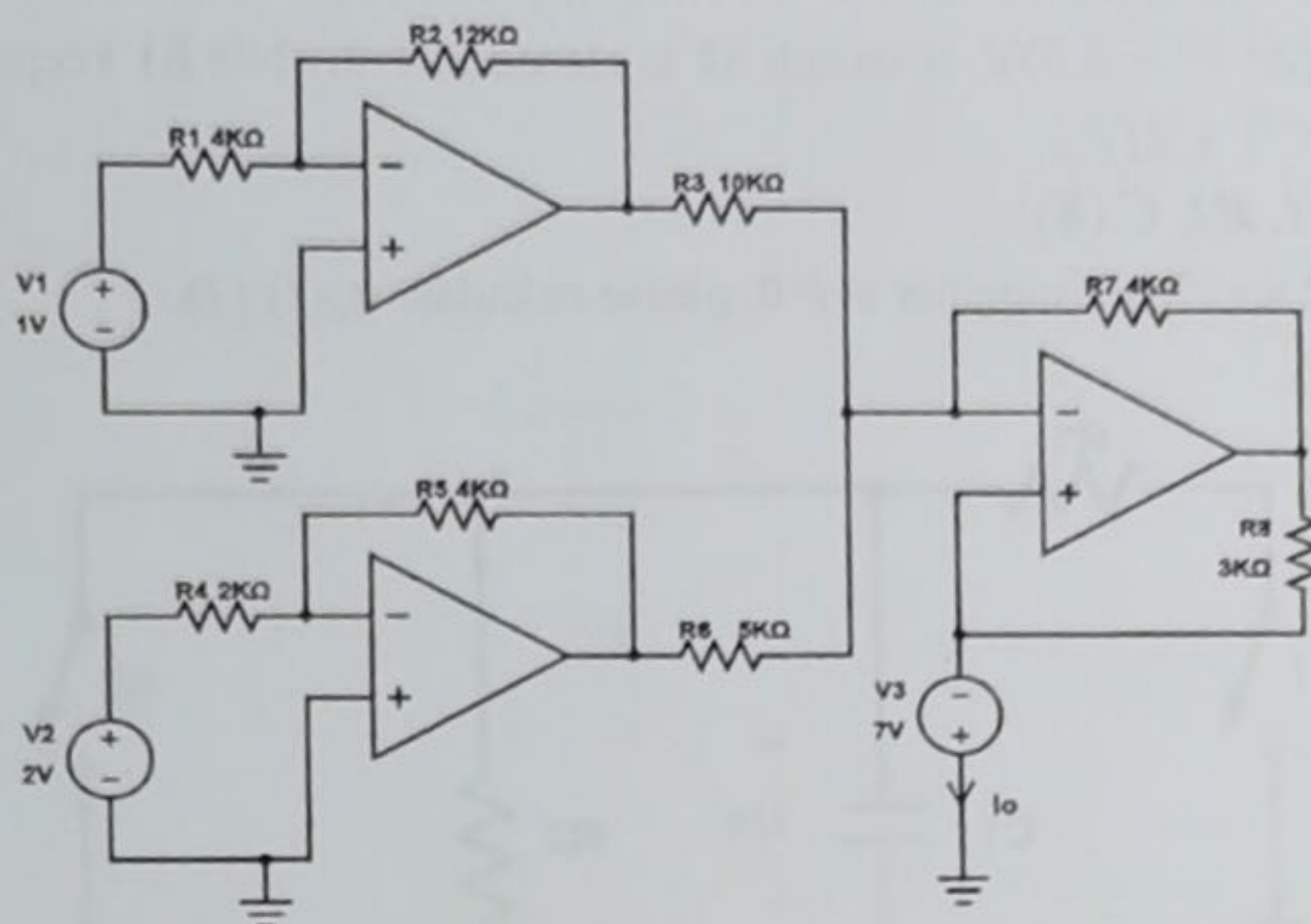


6. (10) In the circuit below, N is an unknown linear circuit with some DC sources in it. The condition is as below:

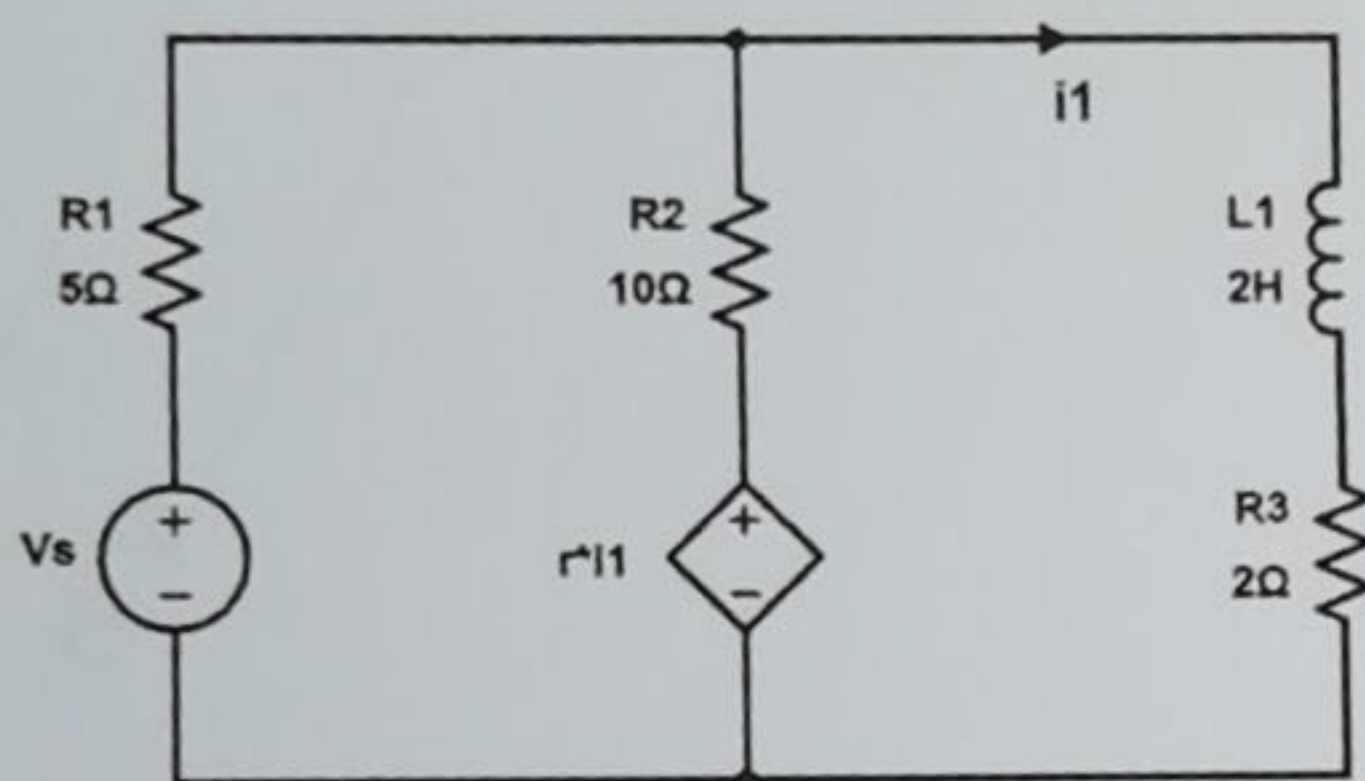
- When $V_I=0$, $I_I=0$, the output voltage U is $-4V$
 - When $V_I=4V$, $I_I=6A$, the output voltage U is $22V$
 - When $V_I=14V$, $I_I=5A$, the output voltage U is $47V$
- When $V_I=8V$, $I_I=-3A$, calculate the output voltage U .



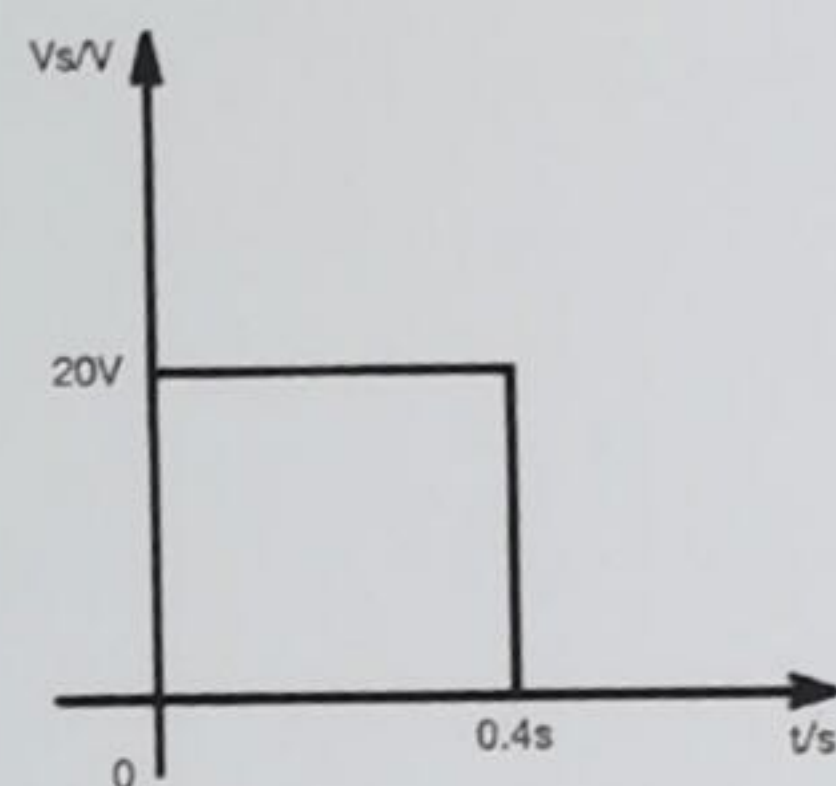
7. (10) If $R_1 = R_5 = R_7 = 4\text{k}\Omega$, $R_2 = 12\text{k}\Omega$, $R_3 = 10\text{k}\Omega$, $R_4 = 2\text{k}\Omega$, $R_6 = 5\text{k}\Omega$, $R_8 = 3\text{k}\Omega$, $V_1 = 1\text{V}$, $V_2 = 2\text{V}$, $V_3 = 7\text{V}$, please calculate I_o .



8. (15) First-Order circuits: the whole circuit is shown in (a), and V_s is shown in (b). The initial value of i_1 is 2A . $r = 1\Omega$. Please calculate $i_1(t)$.



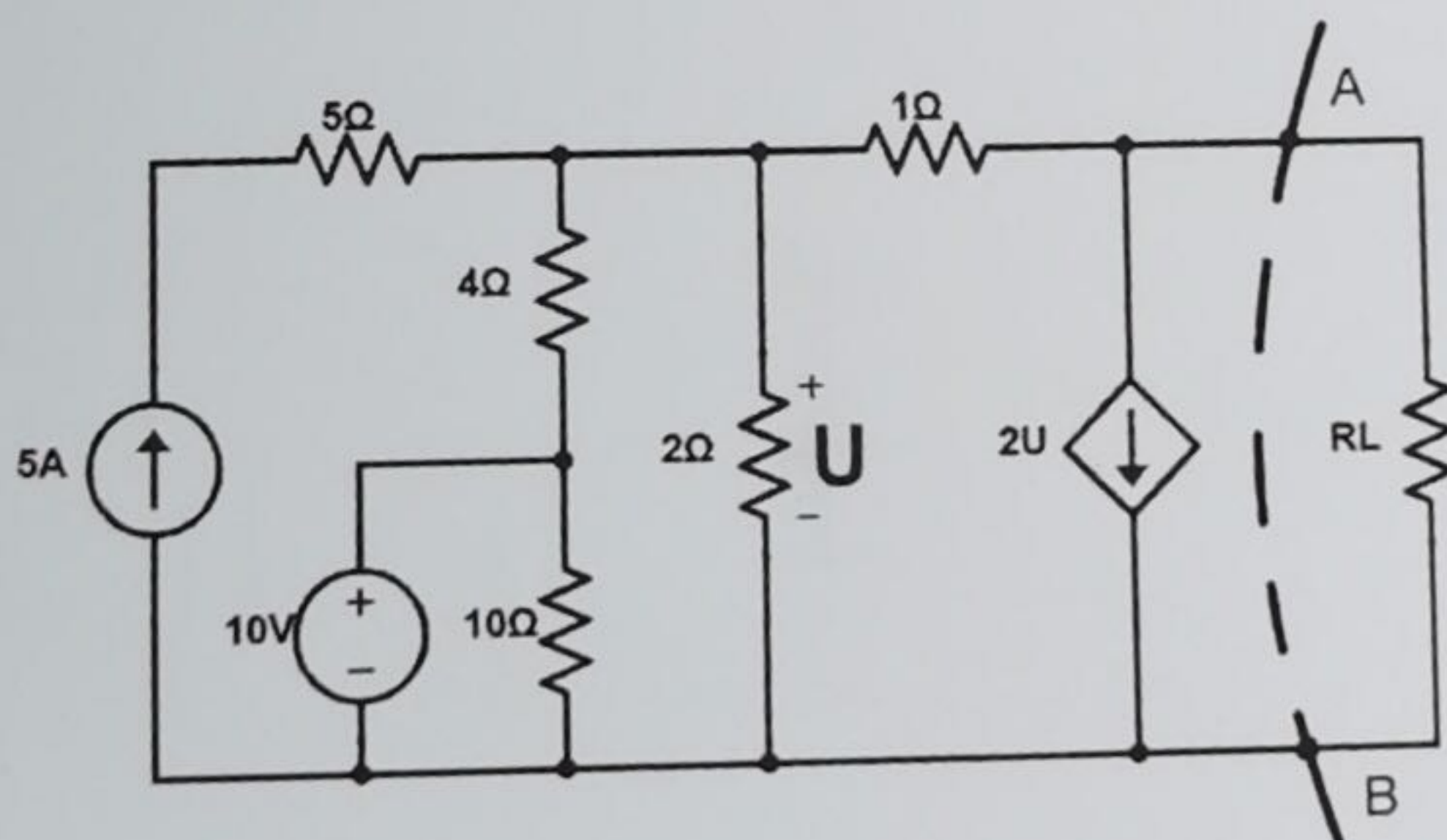
(a)



(b)

9. (12)

- Calculate the Thevenin Circuit of the left part of terminal AB. (8)
- How much should load resistance R_L be to get the largest power, and how much is the power? (4)



Bonus:

10. (15) In the circuit below, $U_s=1\text{V}$, $I_s=1\text{A}$. If switch **S1** is closed at $t=0$ while **S2** remains opening, then $u_c^{(1)}(t) = (2e^{-2t} + 0.5)\text{V}$; if switch **S2** is closed at $t=0$ while **S1** keeps opening, then $u_c^{(2)}(t) = (0.5e^{-2t} + 2)\text{V}$.
- a. Calculate $R1, R2, C$.(8)
- b. If **S1** and **S2** are closed together at $t=0$, please calculate $u_c(t)$.(7)

