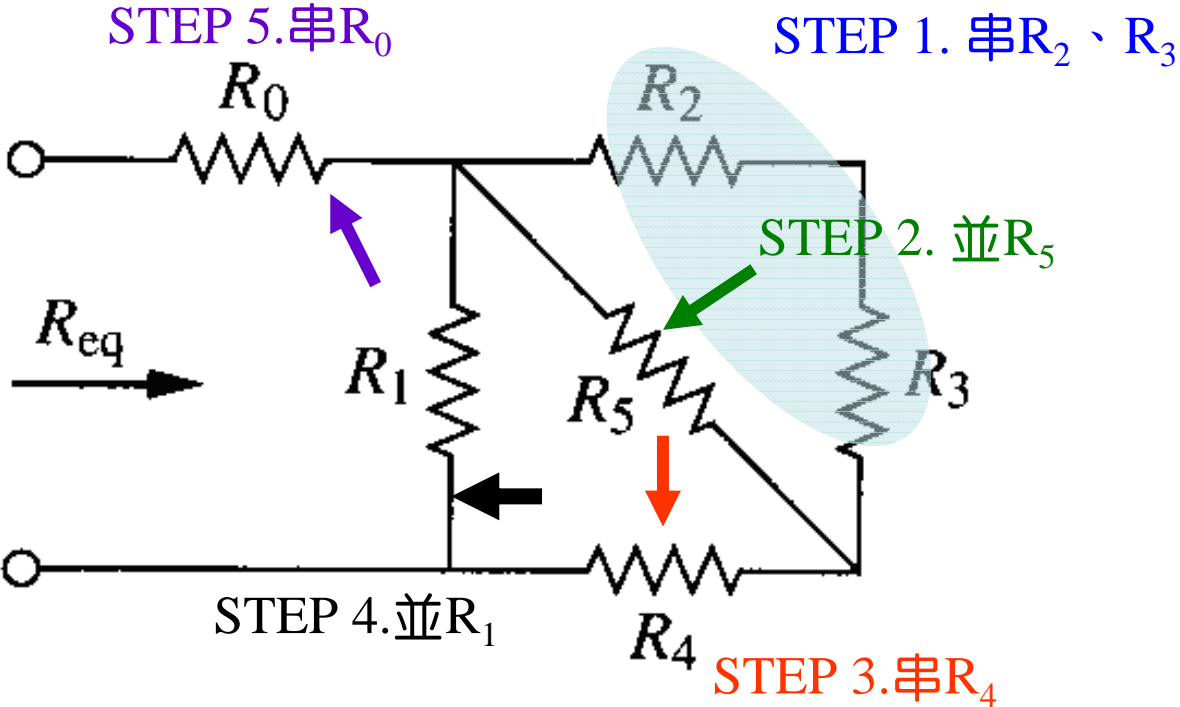


2012/03/14 TAKE HOME

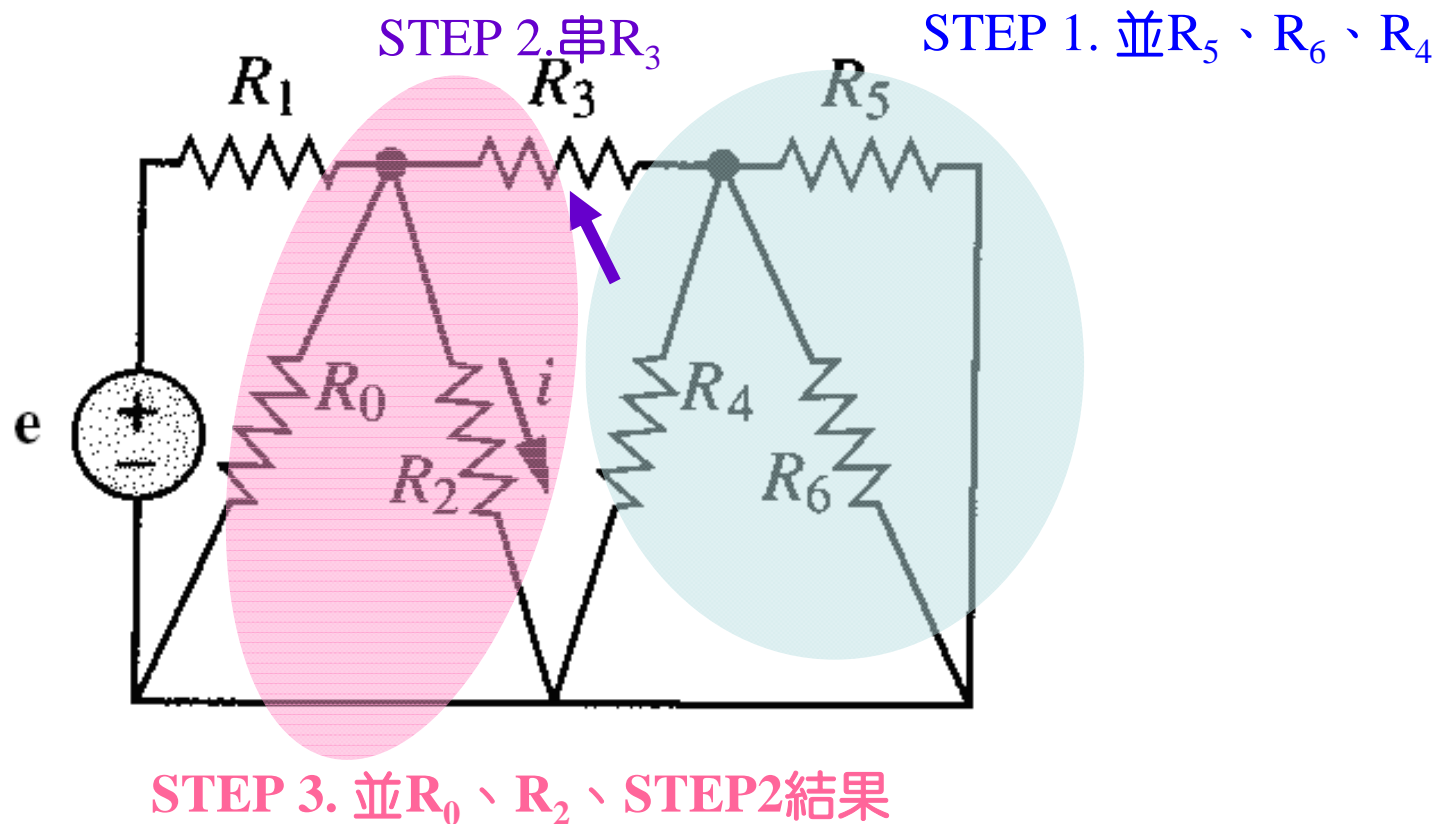
謝志誠

# Problem 1



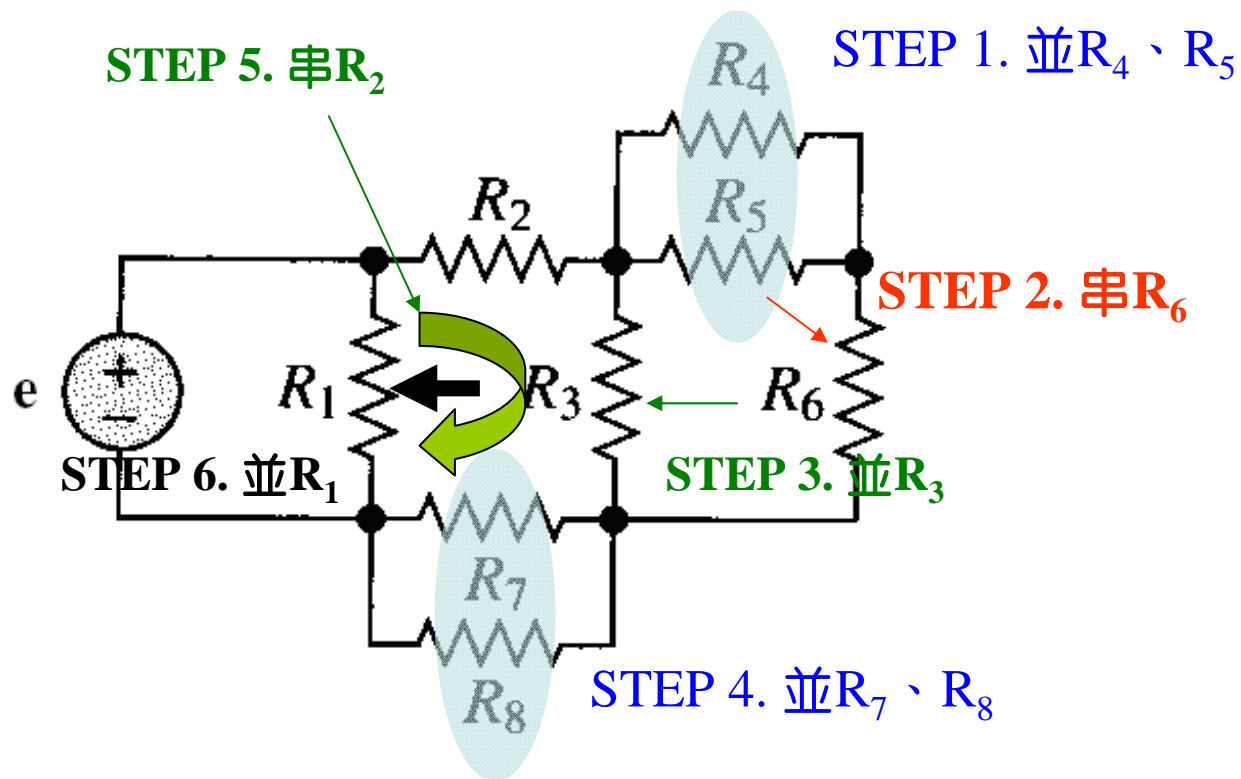
$$R_{EQ} = \underbrace{\left( \underbrace{\left( \underbrace{R_2 + R_3}_{1} \right) \parallel R_5}_{2} + R_4 \right) \parallel R_1}_{3} + R_0 \quad 4$$

# Problem 2



$$R_{EQ} = \underbrace{\left( \left( \left( R_5 // R_6 // R_4 \right) + R_3 \right) // R_2 // R_0 \right) + R_1}$$

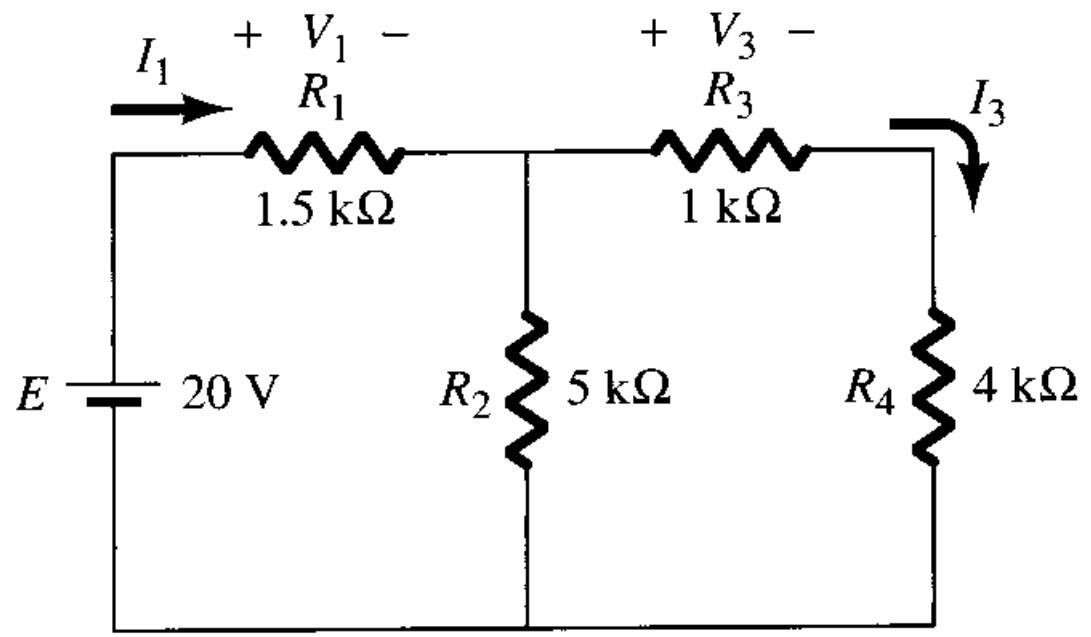
# Problem 3



$$R_{EQ} = \underbrace{\underbrace{\underbrace{((R_4 // R_5) + R_6)}_1 // R_3}_2 + R_2 + \underbrace{(R_7 // R_8)}_4} // R_1$$

# Problem 4

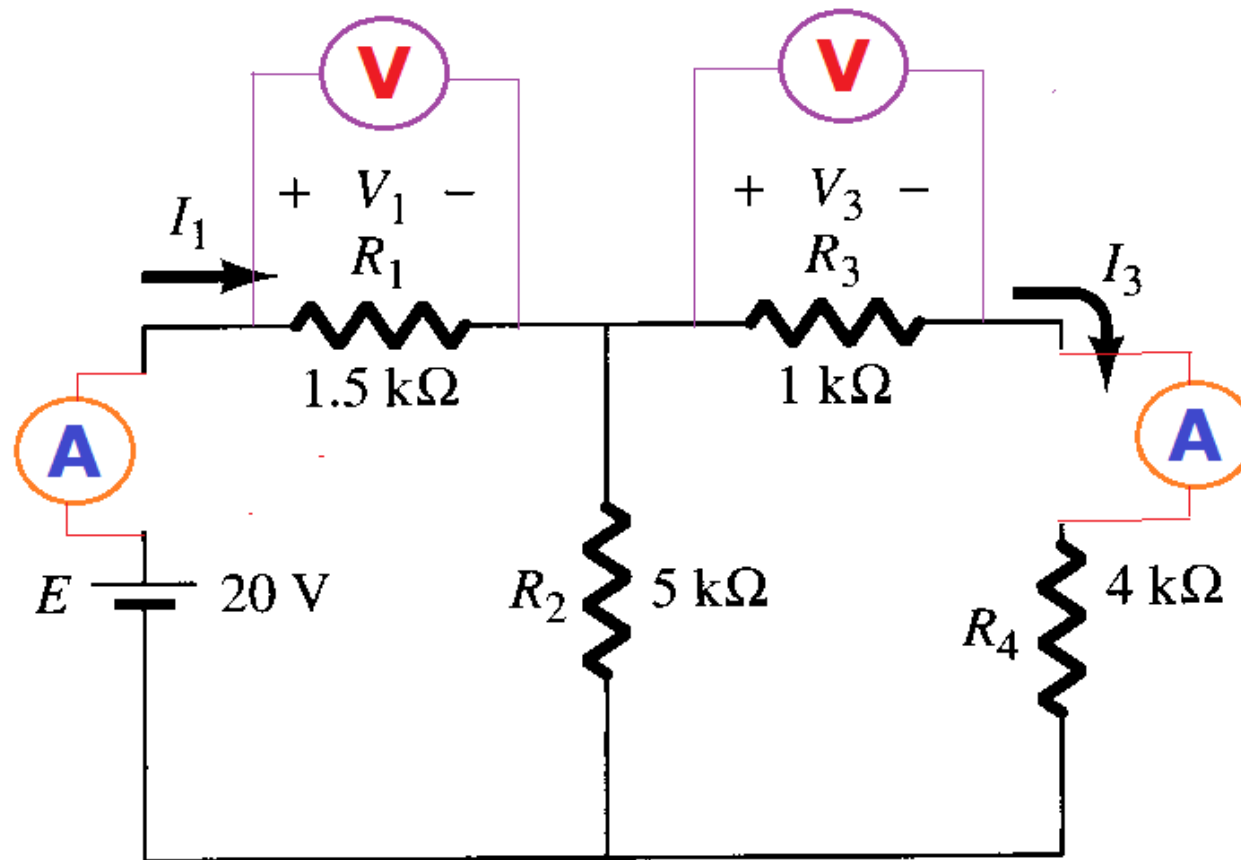
- a. Sketch the location and connecting of ammeters and voltmeters used to measure the currents  $I_1$  and  $I_3$  and voltages  $V_1$  and  $V_3$  in Fig. 2.71.
- b. Using a voltmeter with an ohm-per-volt rating of 1000, determine the indication of meter when it is placed across the  $4\text{-k}\Omega$  resistor if the 50-V scale is used.
- c. Repeat part (b) for a meter employing an ohm-per-volt rating of 20,000.
- d. Repeat part (b) for a DMM with an internal resistance of  $11\text{ M}\Omega$ .
- e. Show the connection for a wattmeter reading the power delivered to  $R_3$  and  $R_4$ .



**FIG. 2.71**

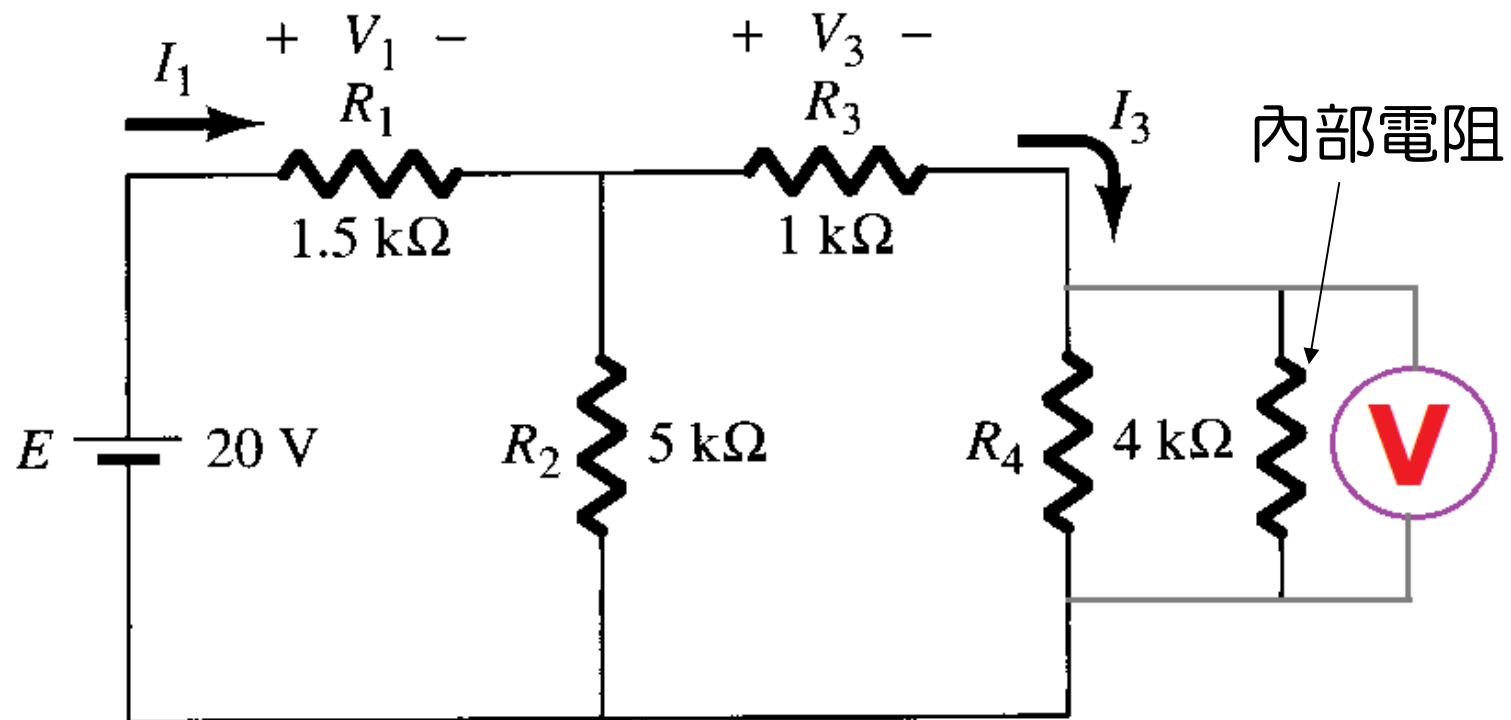
Voltmeter與被量測者並聯

Ammeter與被量測者串聯

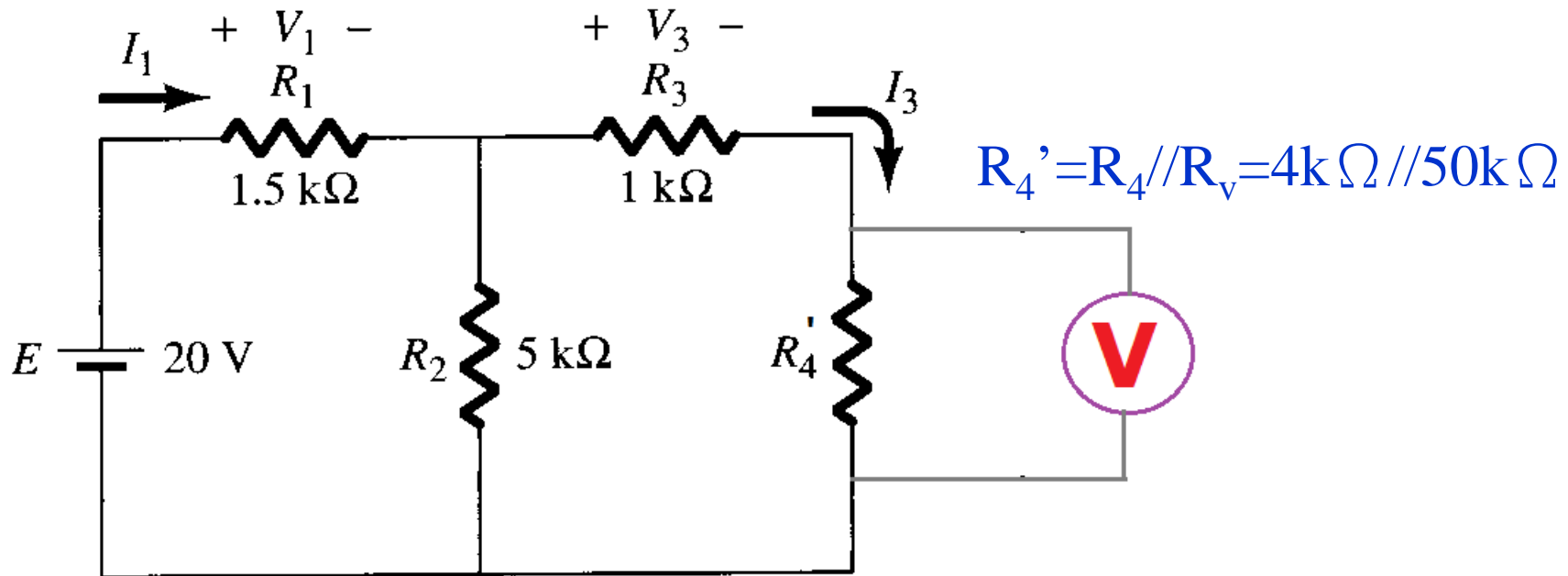


**Voltmeter** : 内部電阻//理想伏特計

**Ammeter** : 内部電阻//理想電流計





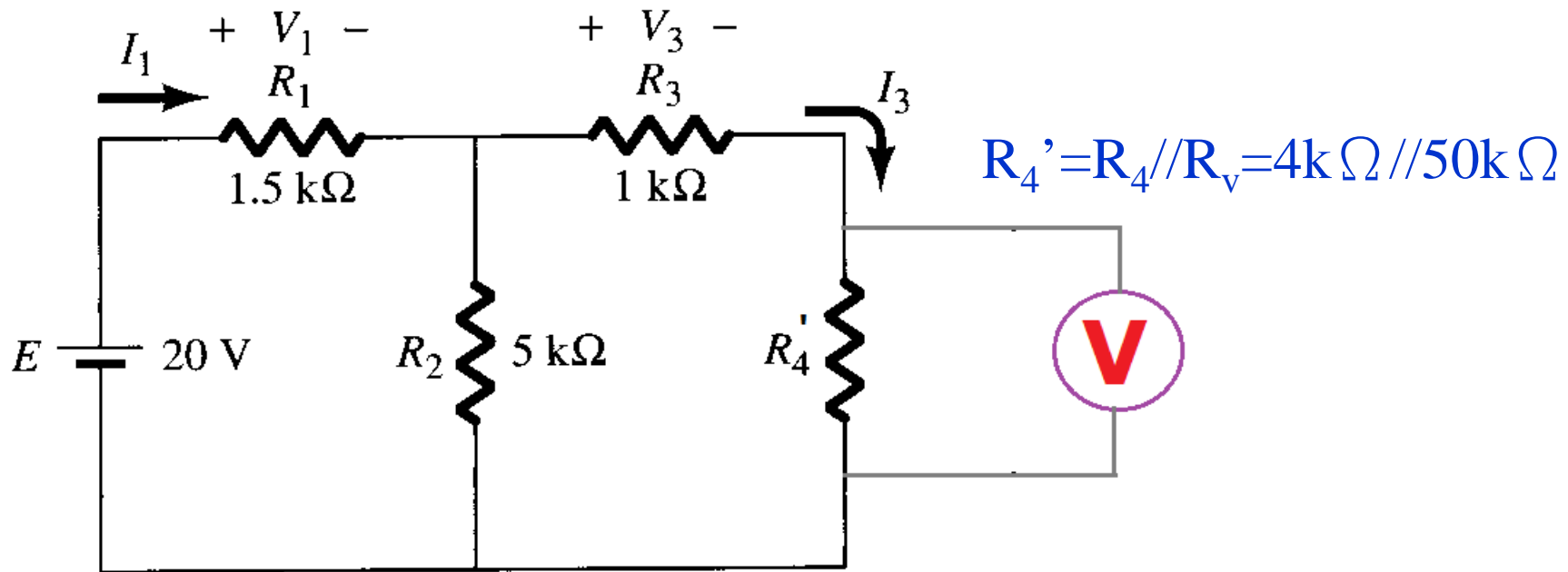


The ohm-per-volt rating of voltmeter is  $1000 \Omega/V$  ,

若把伏特計的scale設定於50V，則伏特計的內部電阻 $R_v$ 為50k $\Omega$ ；此時，把伏特計接上 $R_4$ ，量取 $R_4$ 的電壓降時，原本電路結構將因伏特計內部電阻的出現而改變。

$$R_4' = R_4 // R_v = 4\text{k}\Omega // 50\text{k}\Omega = 3.704\text{k}\Omega$$

要計算真正的電壓降，就求出 $I_3$ ...



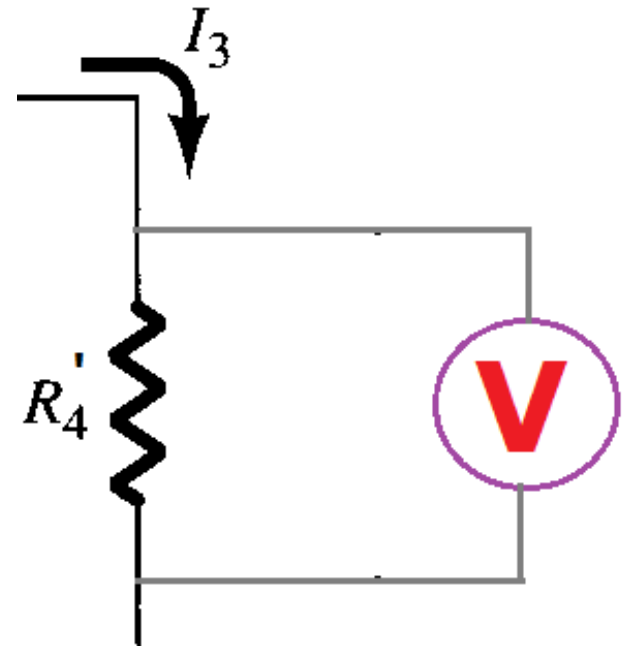
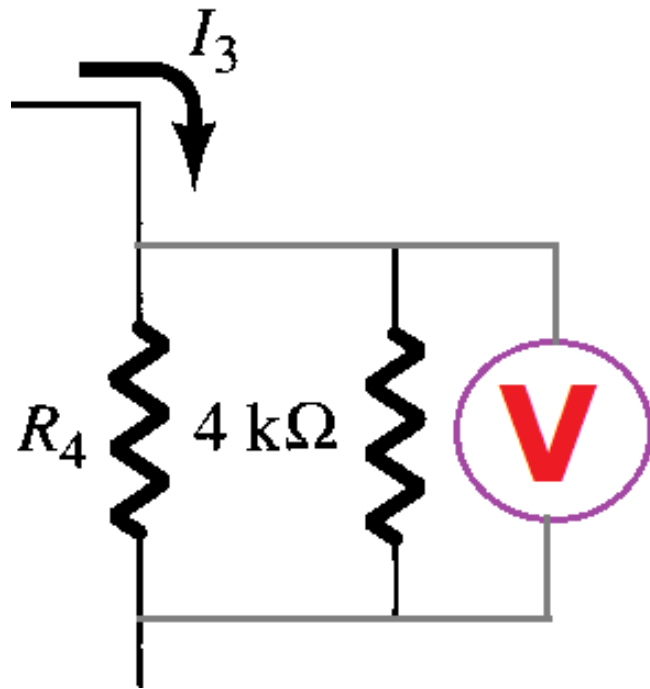
要求 $I_3$ ...就得先求出 $I_1$ ，要求 $I_1$ 就得先有 $R_T$

$$R_T = ((R_4' + R_3) // R_2) + R_1 = \dots = 3.924\text{k}\Omega$$

$$I_1 = \frac{E}{R_T} = \frac{20\text{V}}{3.924\text{k}\Omega} = 5.097\text{mA}$$

然後，利用current divider rule

$$I_3 = I_1 \times \frac{R_2}{R_4' + R_3 + R_2} = \dots = 2.626\text{mA}$$



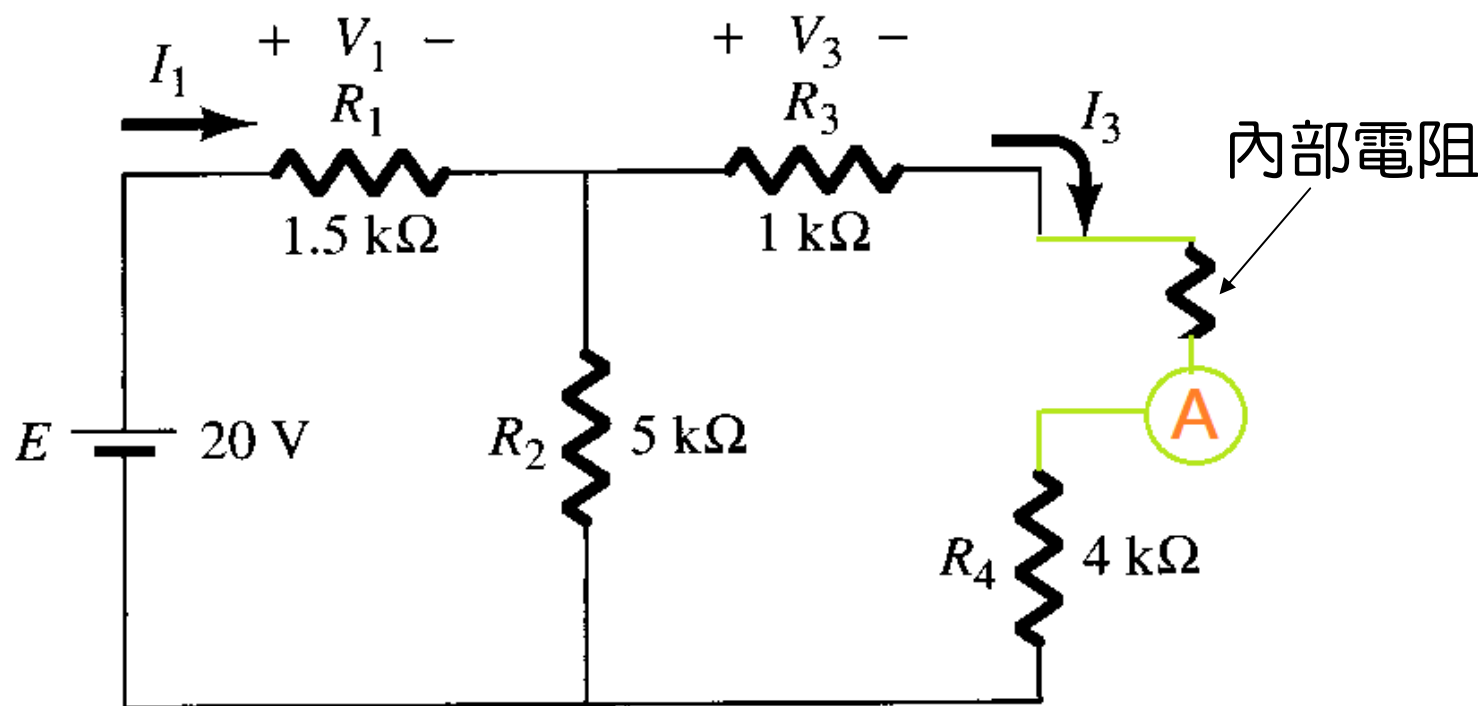
$$V_4 = I_3 \times R_4' = I_3 \times \frac{R_4 \times R_v}{R_4 + R_v}$$

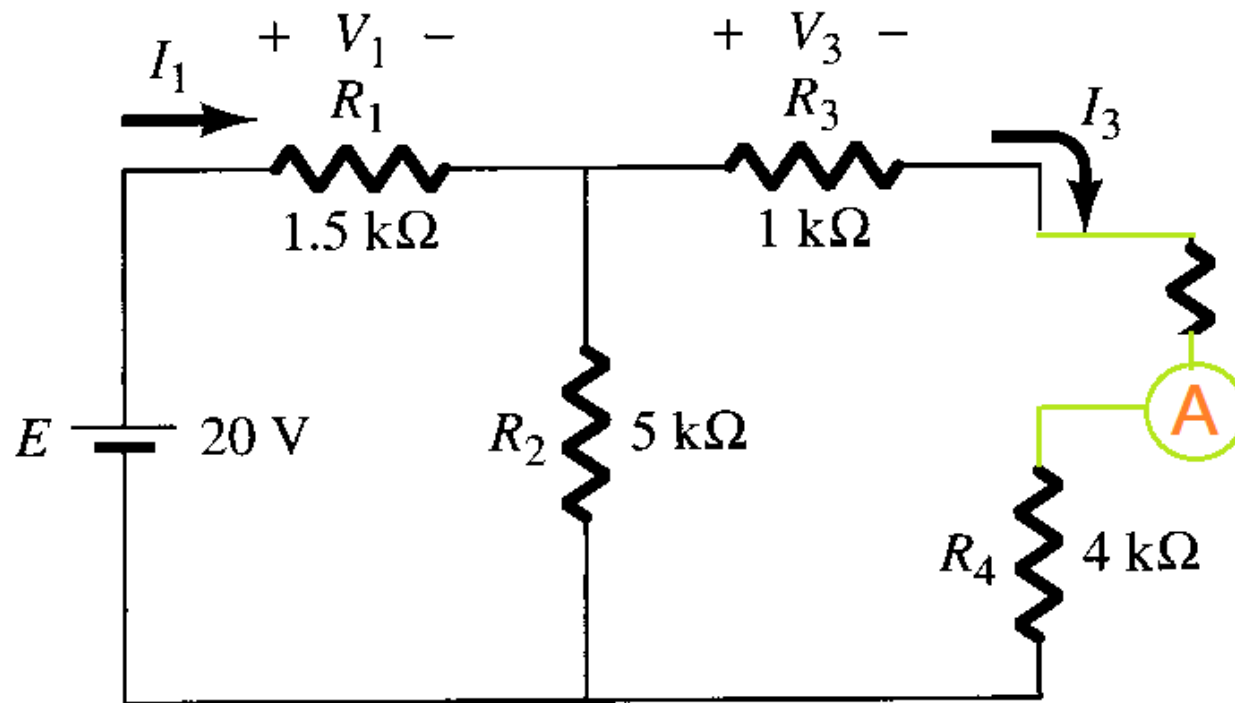
$$= \dots = 9.73\text{V}$$

$$V_4 = R_4 \times \left( I_3 \times \frac{R_v}{R_4 + R_v} \right) = \dots = 9.73\text{V}$$

# Exercise 52 延伸命題

Using a ammeter with an ohm-per-amp rating of 5000, determine the indication of meter when it is placed to measure the current  $I_3$  if the 20 mA scale is used.

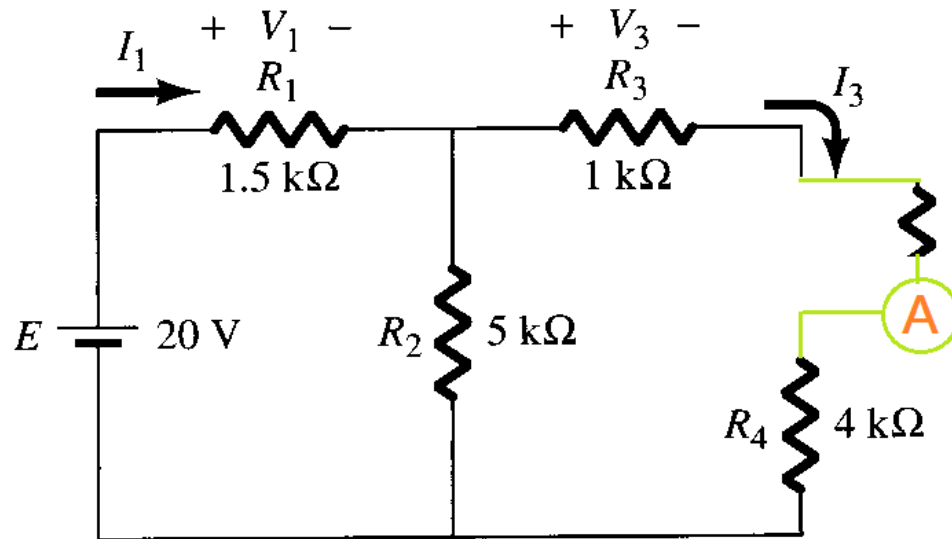




The ohm-per-amp rating of ammeter is  $5000\ \Omega/\text{A}$  ,

若把電流計的scale設定於20 mA，則電流計的內部電阻 $R_a$ 為 $100\ \Omega$ ；此時，把電流計串聯接於 $R_3$ 與 $R_4$ ，量取流通的電流，原本電路結構將因電流計內部電阻的出現而改變。

真正的電流？就求出 $I_3$ ...



要求 $I_3$ ...就得先求出 $I_1$ ，要求 $I_1$ 就得先有 $R_T$

$$R_T = ((R_4 + R_a + R_3) // R_2) + R_1 = \dots$$

$$I_1 = \frac{E}{R_T} =$$

然後，利用current divider rule

$$I_3 = I_1 \times \frac{R_2}{R_4 + R_a + R_3 + R_2} = \dots$$