

EE 220

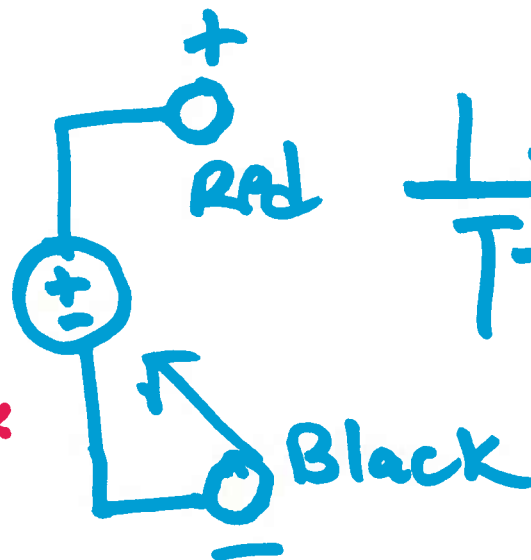
Spring 2017

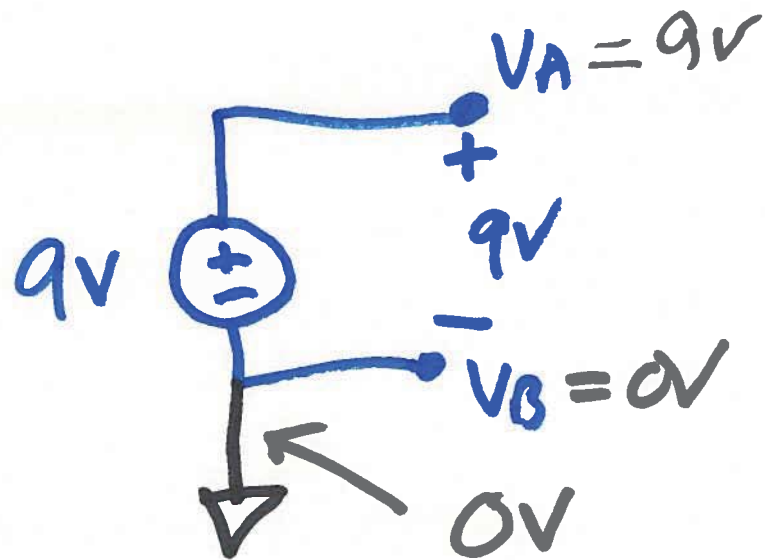
Circuits I

Lecture 1

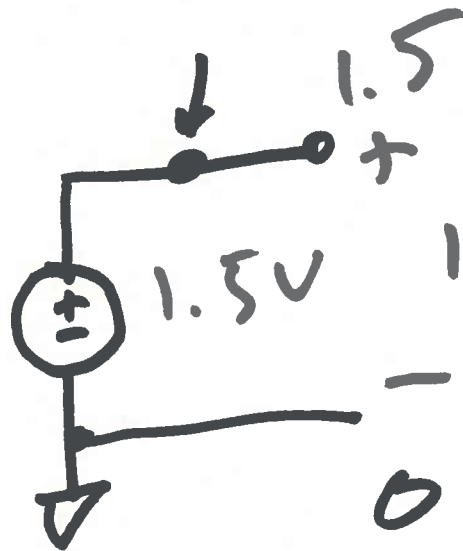
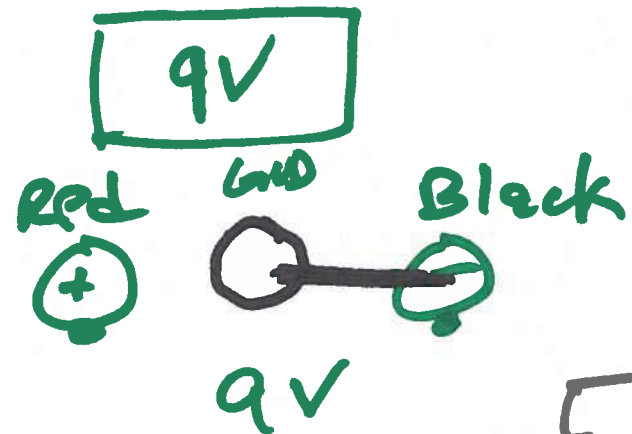


Battery

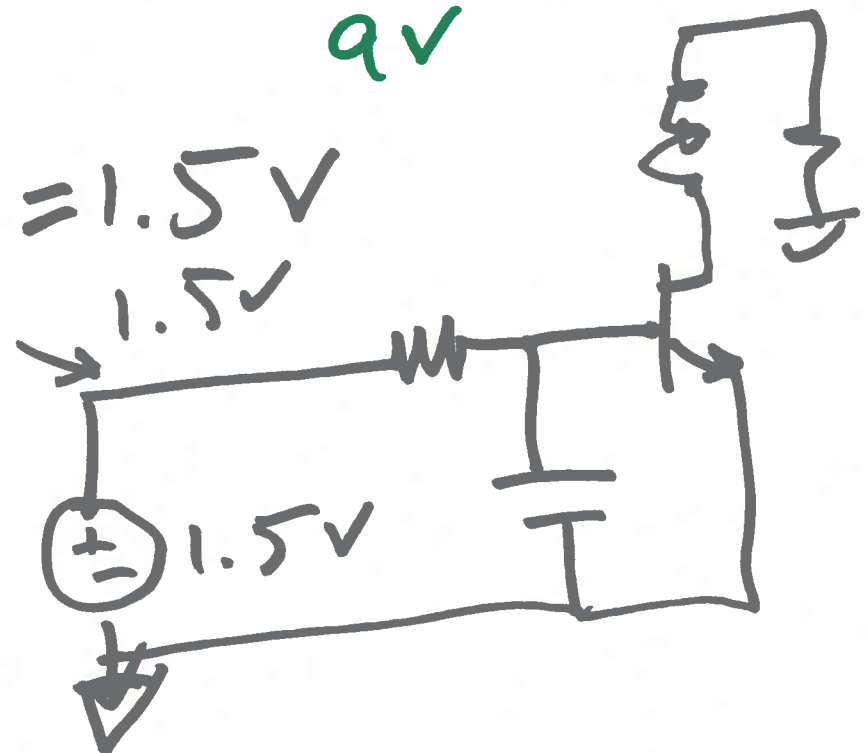


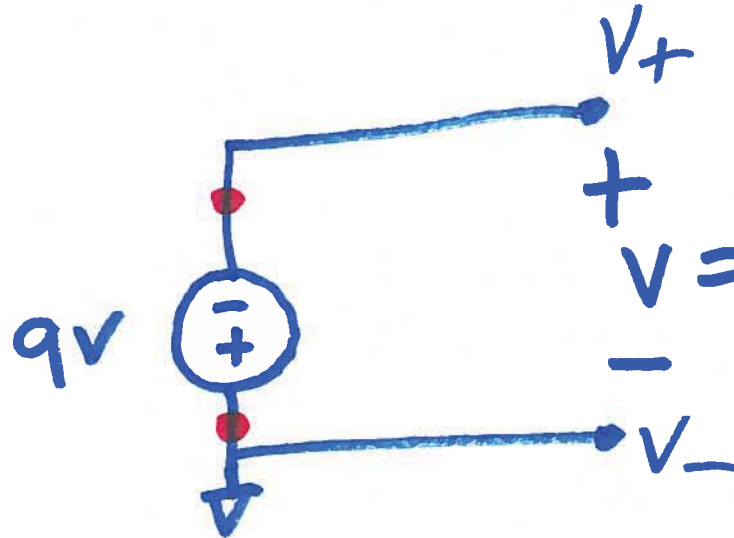
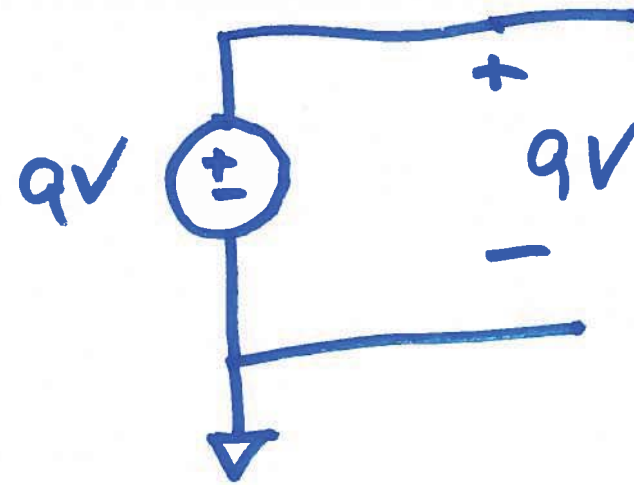
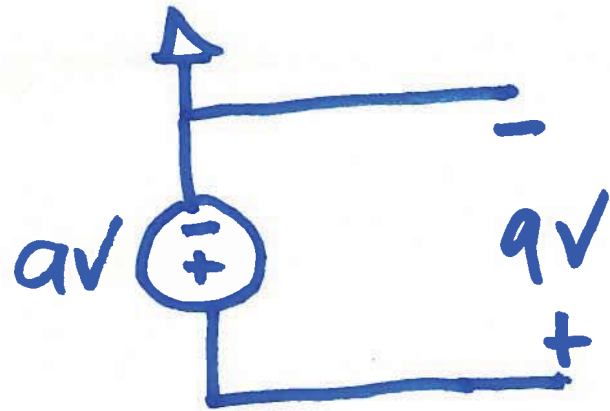


$$V_A - V_B = 9$$



$$1.5 - 0 = 1.5V$$

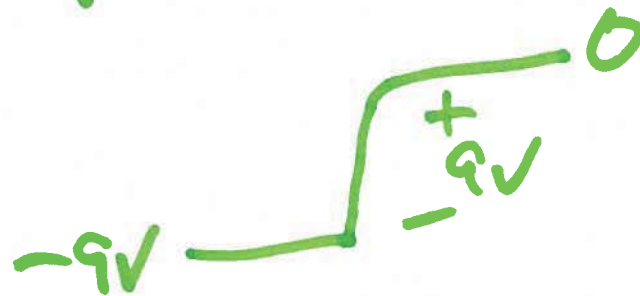
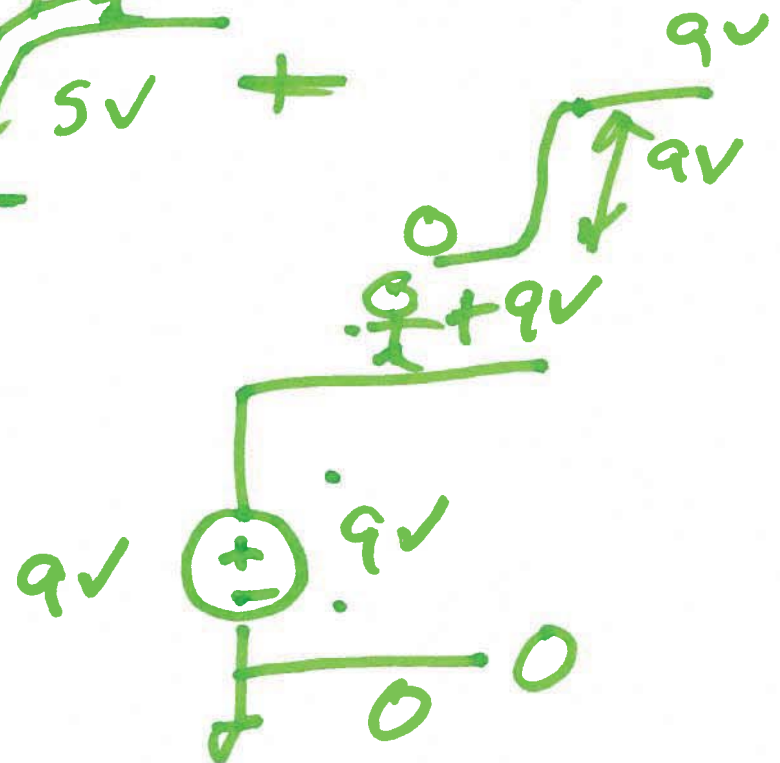
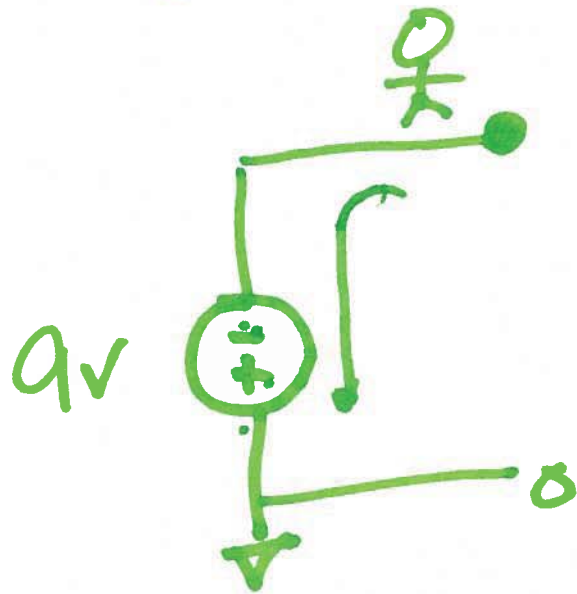
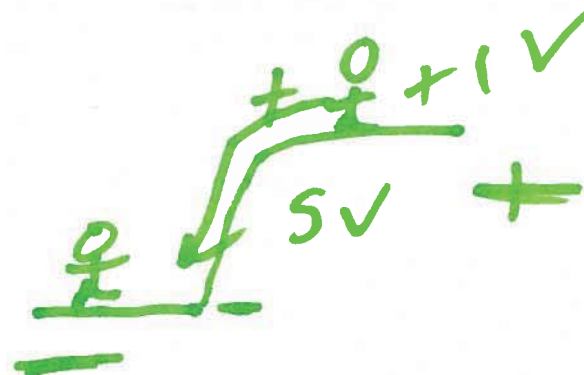
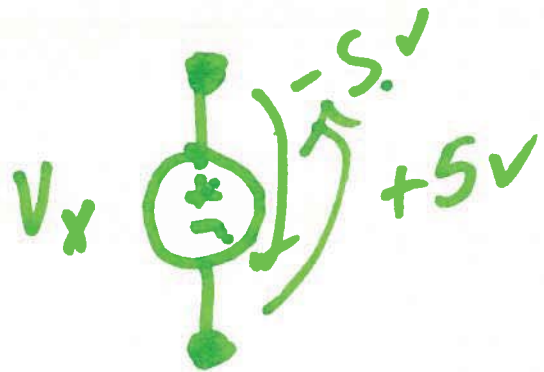


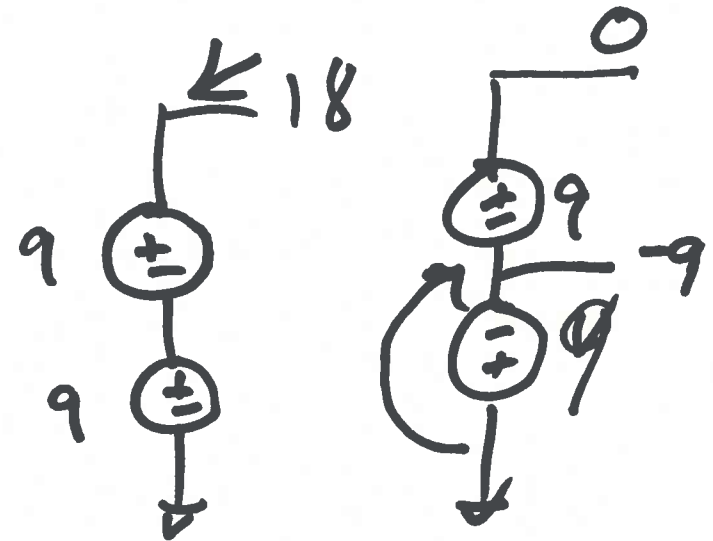
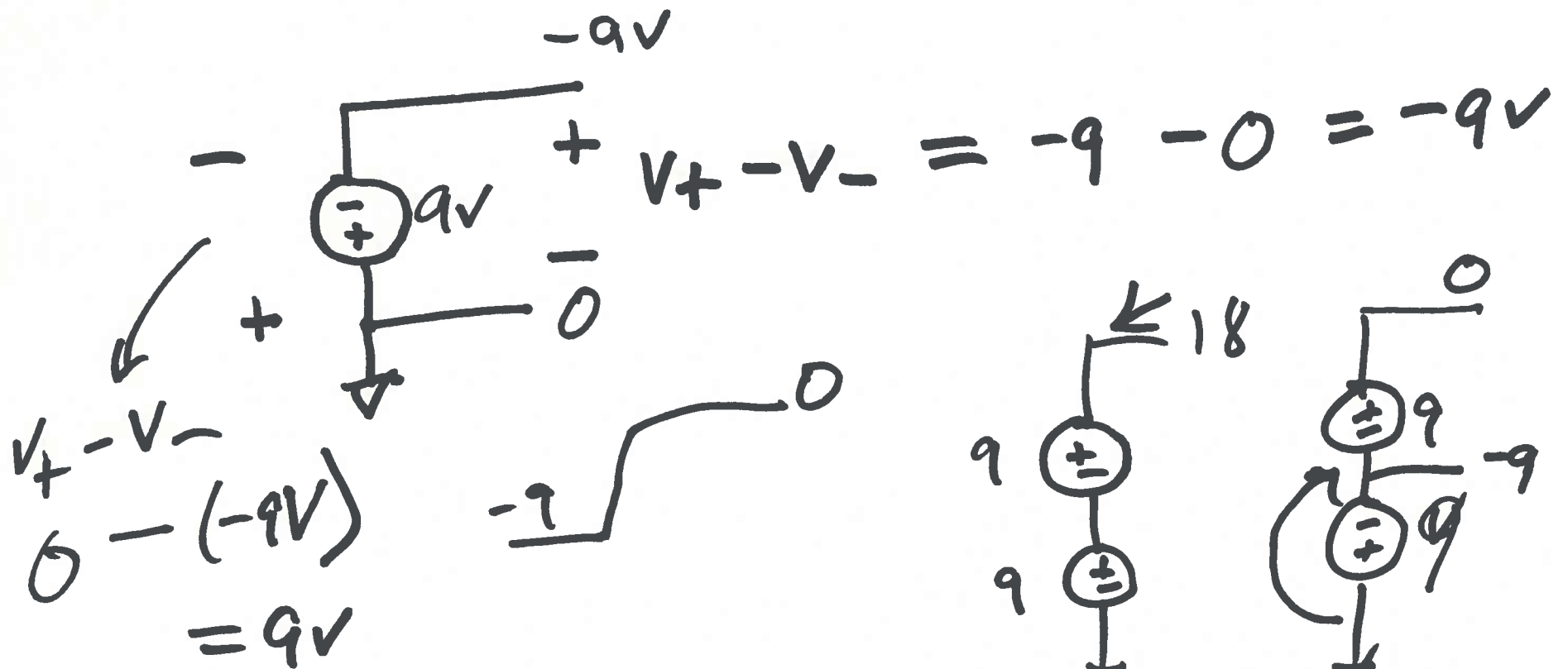
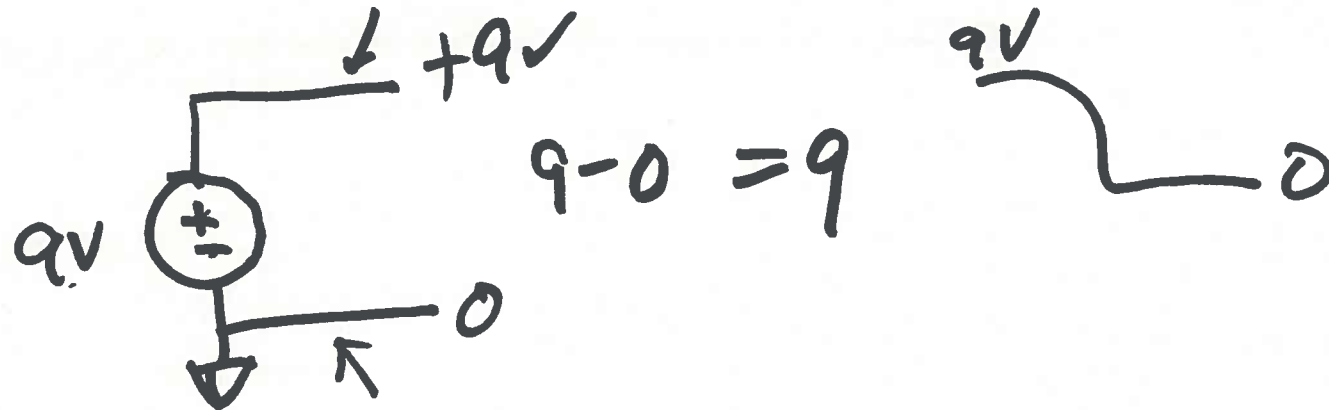


$$V = V_+ - V_- = 0 = -9V$$

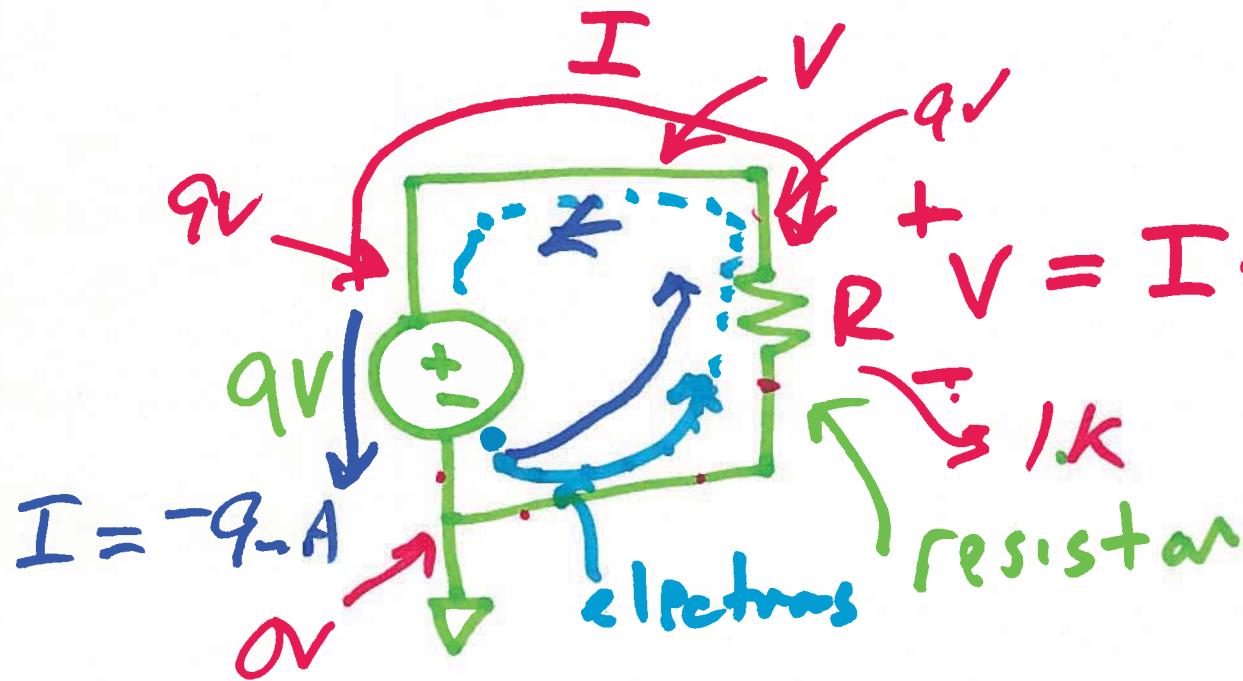
$$V_- - V_+ = 9V$$

$$V_+ = -9V$$





# Ohm's law



$$V = I \cdot R = 9$$

$$I = \frac{9V}{1k}$$

$$= 9mA$$

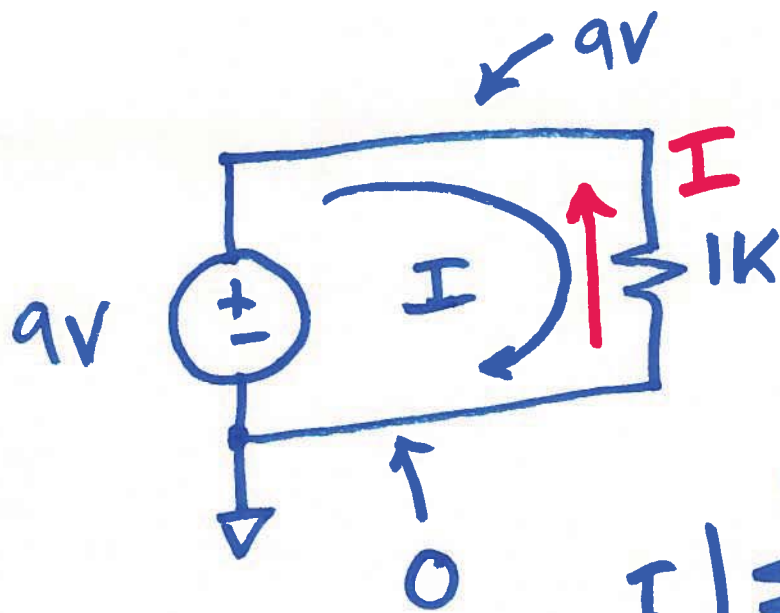
$$9 \times 10^{-3} A$$

$$\downarrow -9mA$$

$$\uparrow 9mA$$

$$I = \frac{\text{Coulombs}}{s} = \text{Amperes (Amps)}$$

$$\begin{matrix} + \\ - \end{matrix} 9V \Rightarrow \begin{matrix} - \\ + \end{matrix} 9V$$



$$+V_R = 9V \quad \begin{matrix} - \\ + \end{matrix} V = 9V = -V_R$$

$$I \downarrow \begin{matrix} + \\ - \end{matrix} V = IR = 9V = I \cdot 1K$$

$$I = \frac{9}{1K} = \underline{\underline{9\mu A}}$$

$$I \uparrow \begin{matrix} + \\ - \end{matrix} V = -I \cdot R$$

$$9 = -I \cdot 1K$$

$$I = \underline{\underline{-9\mu A}}$$

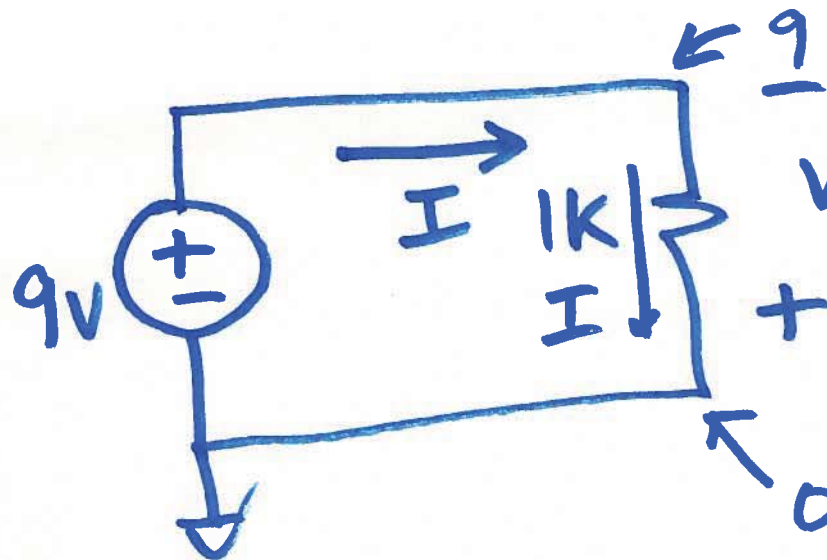
$$I \downarrow \begin{matrix} - \\ + \end{matrix} V \quad \begin{matrix} -V = IR \\ V = -IR \end{matrix}$$

$$I \uparrow \begin{matrix} - \\ + \end{matrix} V = -I \cdot R$$

$$V = IR \Rightarrow$$

$$-9 = I \cdot 1K \quad I = \frac{-(-9)}{1K}$$

$$I = \underline{\underline{-9\mu A}} = \underline{\underline{9\mu A}}$$



$$v = 0 - 9 = -9V$$

$$v = IR$$

$$-v = IR$$

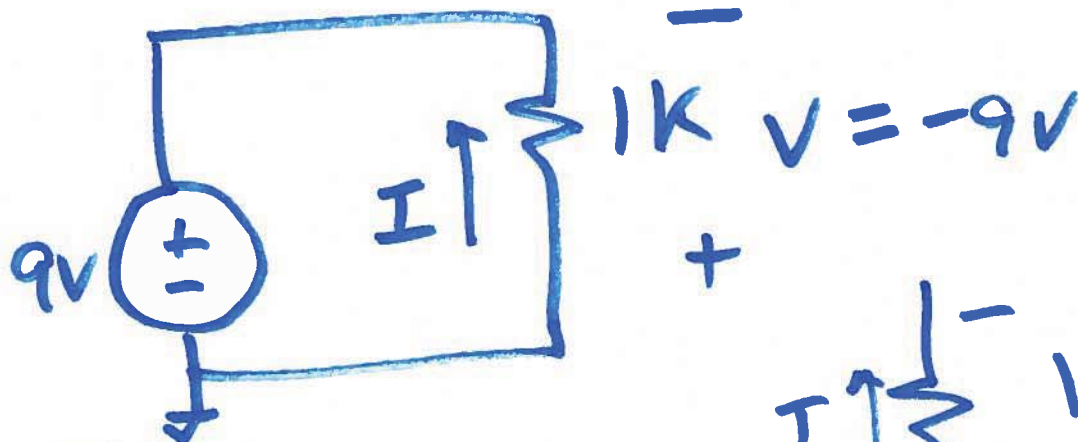
$$-(-9) = I \cdot 1k$$

$$I = 9 \mu A$$

$$v = I \cdot R$$

$$-v = -I \cdot R$$

$$I = \frac{9}{1k} = 9 \mu A$$

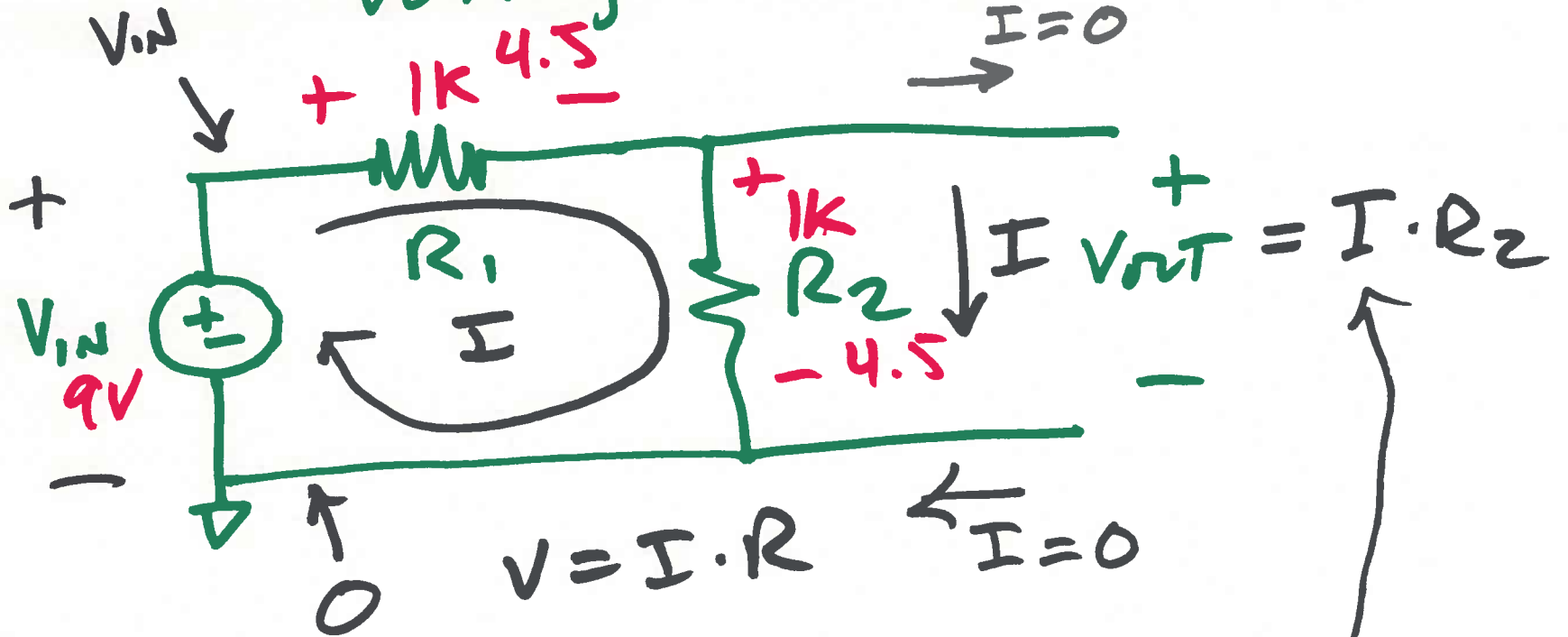


$$v = -9V$$

$$-v = -I \cdot R$$

$$I = \frac{9}{1k} = 9 \mu A$$

# Voltage dividers



$$I \cdot (R_1 + R_2) = V_{in}$$

$$V_{out} = V_{in} \cdot \frac{R_2}{R_1 + R_2}$$

$$I = \frac{V_{in}}{R_1 + R_2}$$

$$V_{out} = 9V \cdot \frac{1k}{1k + 1k} = 4.5V$$