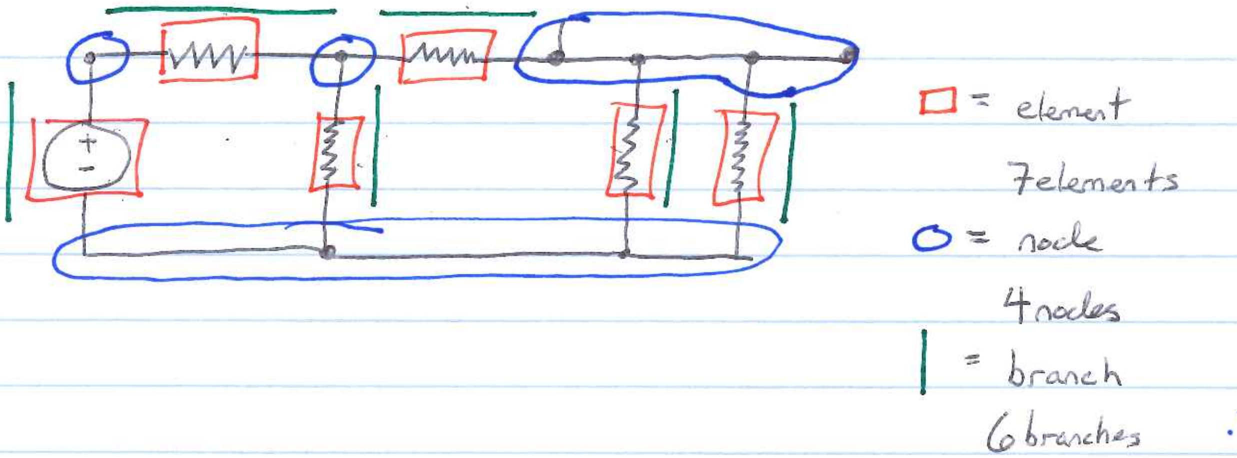


node: a point at which 2 or more elements share a common connection
a wire can be a node.

branch: a single path in a network where one simple element has a node at each end.

Chapter 2: centi : 10^{-2}

milli : 10^{-3} kilo: 10^{3}

micro : 10^{-6} mega: 10^{6}

nano : 10^{-9} giga: 10^{9}

pico : 10^{-12} tera: 10^{12}

femto: 10^{-15} peta: 10^{15}

electron = -1.602×10^{-19} C proton = $+1.602 \times 10^{-19}$ C

current is rate of charge flow $i = \frac{dq}{dt}$

Derivative : $2x \frac{d}{dx} = 2$ = rate of change = slope

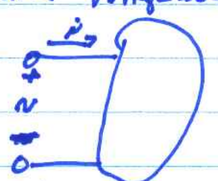
charge transfered between t_0 + t is $\int_{q(t_0)}^{q(t)} dq = \int_{t_0}^{t} i\,dt'$

∴ total charge transfered over time : $q(t) = \int_{t_0}^{t} i\,dt' + q(t_0)$

C/s

Voltage : potential difference between 2 points. "voltage across elements"

1 Volt = 1 J/C



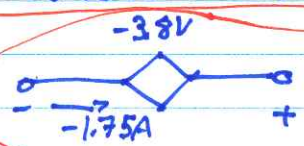
Power = $VI = \frac{J}{C} \times \frac{C}{s} = J/s$

element absorbs V·I power

supplies −V·I power

2.6 

Power absorbed ? 880 mW

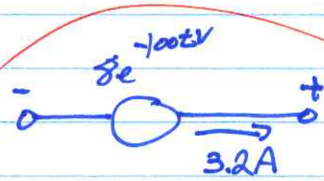


Power generated?

Power absorbed = 1.75A × 38V

= −6.65 W absorbed

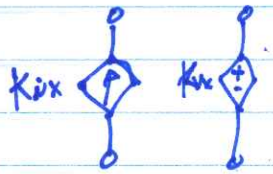
= 6.65 W generated



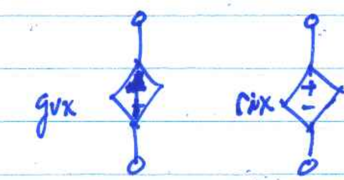
Power Delivered to circuit?

at t = 5ms $-3.2A \times 8e^{-100(5 \times 10^{-3})} = -15.53$ W

Independent sources. Voltage is always the same regardless of current flowing



k is a dimensionless scaling constant.

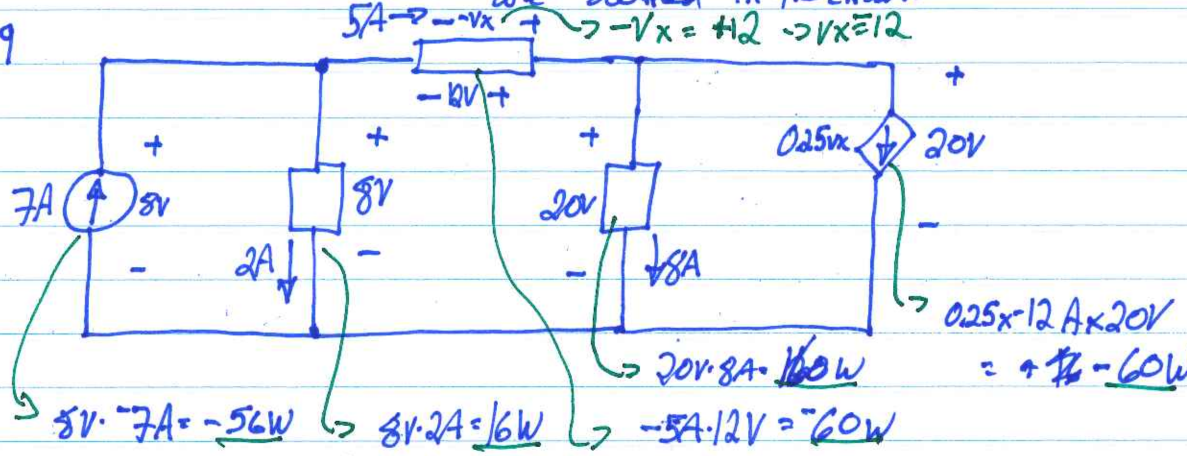


g = A/V

r = V/A

scaling factors where vx & ix are defined in the circuit.

2.9



Ohms Law $V = RI$ resistance = V/A ohm = Ω

absorbs power

$$P = VI \rightarrow V = RI$$

$$P = RI^2 = V^2/R$$

Ex. 2.4 500kV, 600MW $I = \frac{P}{V} = \frac{600 \times 10^6}{500 \times 10^3} = 1.2\,kA$

$$R = \frac{V}{I} = \frac{500 \times 10^3}{1.2 \times 10^3} = 417\,\Omega$$

$R = \rho \frac{l}{A}$ $\rho = \Omega \cdot m$ l = length $\rho = \frac{R \cdot A}{l} = \frac{(417)(1200)}{(24\,miles)\left(\frac{5280\,ft}{mile}\right)\left(\frac{12\,in}{ft}\right)\left(\frac{2.54\,cm}{in}\right)}$

$= 520\,\mu\Omega \cdot cm$

Conductance $\frac{i}{v} = \frac{1}{R} = G$ $1S = \frac{1}{\Omega}$ siemen

linear resistor ratio of current to voltage

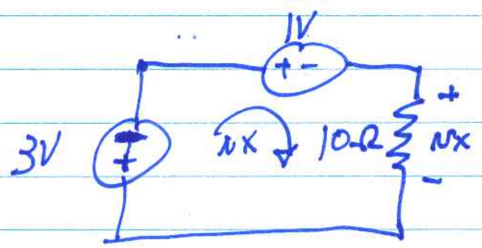
short circuit — resistance of 0Ω voltage across $R = \emptyset$ (current flow)
open circuit — has infinite resistance (current is $\emptyset$, voltage across present)
wires are perfect short circuits

Chapter 3 - Nodes, Loops + Branches

KCL = Kirchoff's Current Law
sum of currents entering a node is zero
charge cannot accumulate at a node

KVL = Kirchoff's Voltage Law
sum of voltages around a closed ~~loop~~ path = $\emptyset$

$$\sum_{n=1}^{N} v_n = \emptyset$$

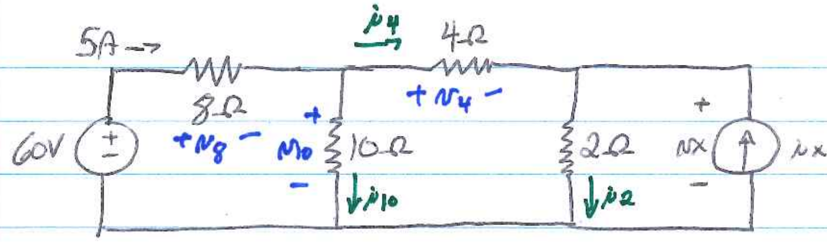


$+3 + 1V + v_x = 0$

$v_x = -4$

$+i_x = \frac{v_x}{R} = \frac{-4V}{10}$

$= -400mA = i_x$



$i_4 + i_x = i_2$ $\qquad$ $-60 + v_8 + v_{10} = 0$

$v_8 = 5A \cdot 8\Omega = 40V = v_8$ $\quad \therefore \quad -60 + 40 + v_{10} = 0$

$v_{10} = 20V$

$i_{10} = 20V / 10\Omega = 2A = i_{10}$

$5A = i_{10} + i_4$ $\quad$ $i_4 = 3A$

~~$5A = i_{10} + i_2 \Rightarrow i_2 = 3A$~~

$V_4 = i_4 \cdot 4\Omega$

$= 3A \cdot 4\Omega = 12V = v_4$

~~$i_4 + i_x = i_2$~~ $\qquad$ $-v_{10} + v_4 + v_x = 0$

$v_x = v_{10} - v_4 = 20 - 12 = 8V = v_x$