Pre-tutorial 1 Questions

Chapter 2, Ex 26: Power

A fuse must be selected for a certain application. You may choose from fuses rated to "blow" when the current exceeds 1.5 A, 3 A, 4.5 A or 5 A. If the supply voltage is 110 V and the maximum allowed power dissipation is 500 W, which fuse should be chosen and why?

$V = 110V$

Max power $= 500W$

What is max current allowed?

$P = VI$ or $I_{max} = \frac{P_{max}}{V} = \frac{500}{110} = 4.545A$

If choose fuse for $I_{max} = 4.5A$

$P = VI = 110 \times 4.5 = 495W$ ✓

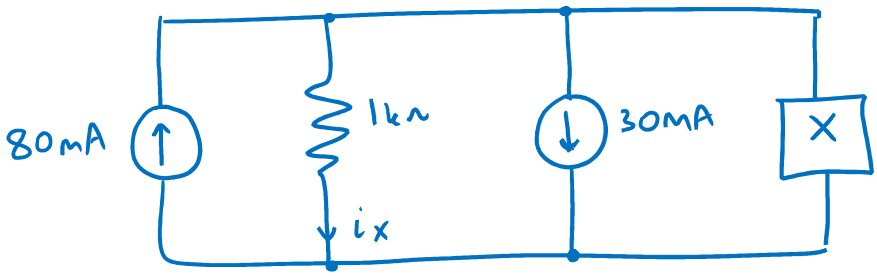
If choose fuse for $I_{max} = 5A$

$P = VI = 110 \times 5 = 550W$ ✗

Our choice is a little conservative. If device draws it maximum current of 500W, then fuse blows.

Similar problem: ch 2 ex 27 in extra problems.

Chapter 3, Ex 38: KCL



Using KCL, find the power absorbed by element X in the circuit above if it is a
(a) 4 kΩ resistor

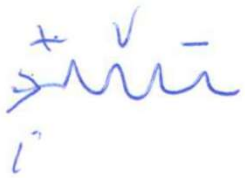
$\sum I_{in} = 0$ (top node)

$80m - \frac{V}{1k} - 30m - \frac{V}{4k} = 0$

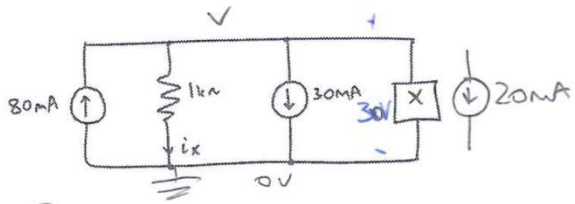
$50m = \frac{5V}{4k}$

$V = 40V$

$P = VI = \frac{V^2}{R} = \frac{40^2}{4k} = 400mW$ absorbed



(b) 20mA independent current source (arrow down)



$\sum I_{in} = 0$

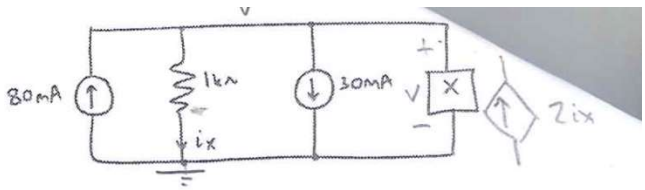
$80m - \frac{V}{1k} - 30m - 20m = 0$

$30m = \frac{V}{1k}$

$V = 30V$

$P = VI = 30 \times 20m = 600mW$ absorbed (charging)

(c) dependent current source (arrow up, labelled $2i_x$)



$\sum I_{in} = 0$

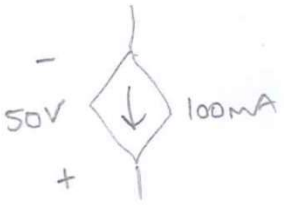
$80mA - i_x - 30mA + 2i_x = 0$

$i_x = -50mA$

$i_x = \frac{V}{1k}$

or $V = i_x \times 1k$

$= -50V$

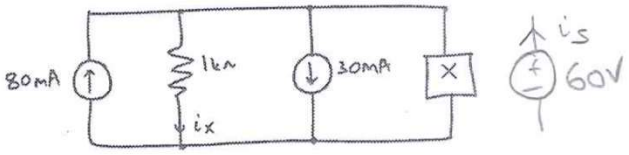


$P = VI = -(-50) \times 2(-50m)$

$= -5W$ absorbed

or 5W generated.

(d) 60V independent voltage source (+ at top)



$i_x = \frac{V}{1k} = \frac{60}{1k} = 60mA$

$\sum I_{in} = 0$

$80mA - i_x - 30m + i_s = 0$

i_x: 60mA

$i_s = 10mA$

$P = VI = 60(-10m) = -600mW$

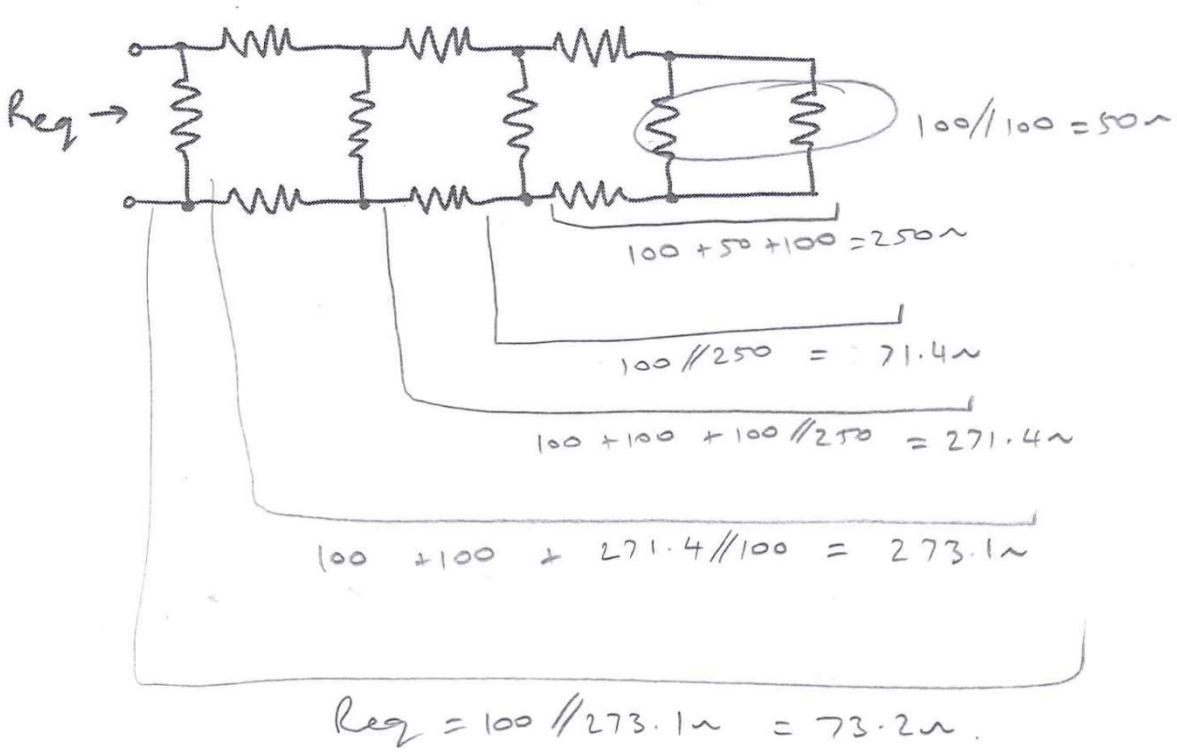
You may want to try Ch 3 ex 36 with KCL.

At Tutorial 1 – Marked Question

Chapter 3, Ex 58: Equivalent resistance

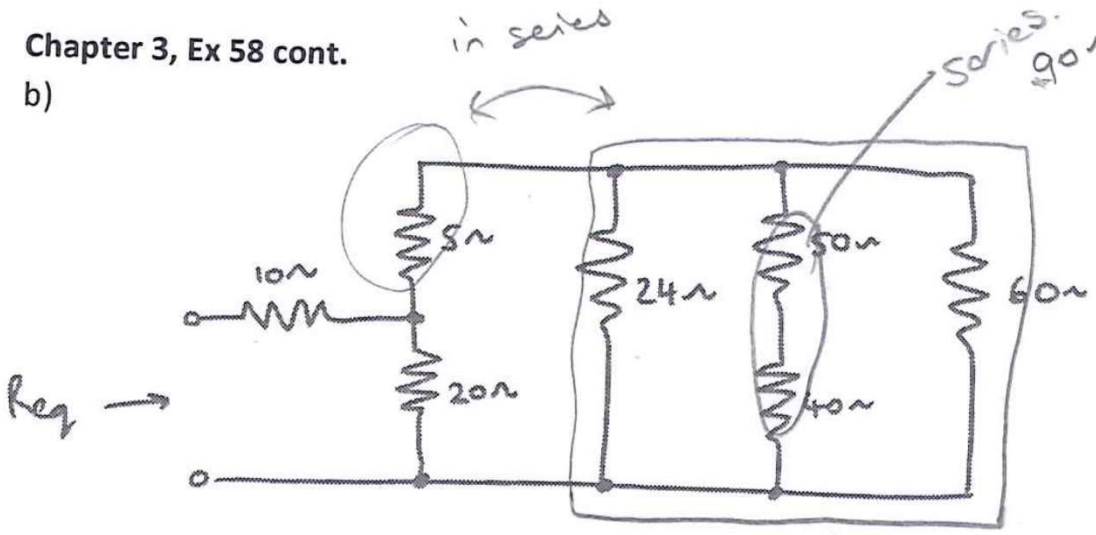
Find the equivalent resistance, R_{eq}, for each of the three resistive networks shown.

a) Each resistor is 100 Ω.



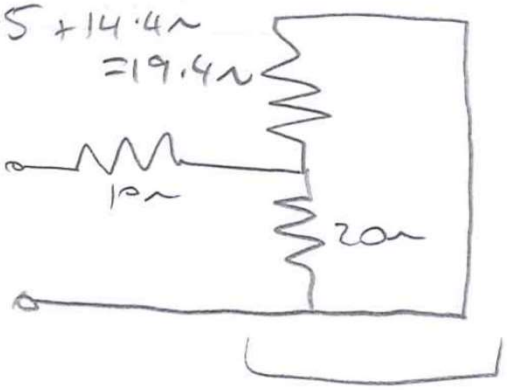
Chapter 3, Ex 58 cont.

b)



$24 // 90 // 60 = 14.4\Omega$.

Parallel.



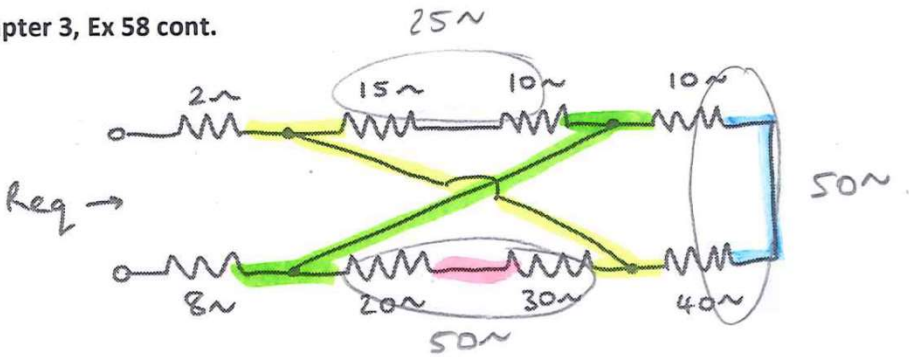
$20 // 19.4\Omega = 9.85\Omega$

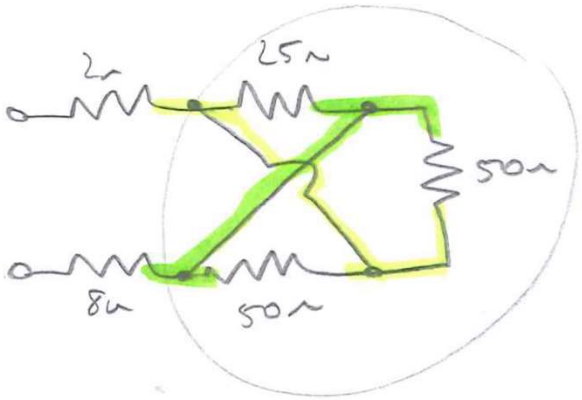
$R_{eq} = 10 + 9.85$

$= 19.85\Omega$

Chapter 3, Ex 58 cont.

c)

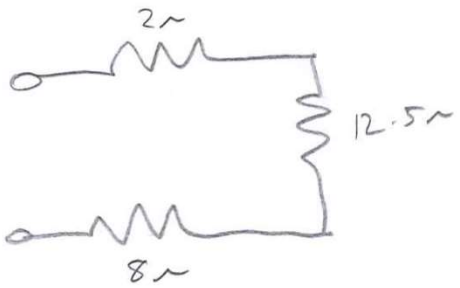




All 3 are between green & yellow nodes

$50 // 25 // 50$

$= 12.5\Omega$.



$2 + 12.5 + 8$

$= 22.5\Omega$

At Tutorial 1 – Unmarked Questions

Chapter 2, Ex 42: Ohm's Law

Determine the magnitude of the current flowing through a 4.7 kΩ resistor if the voltage across it is:

a) 1 mV

$i = v/R$

$= \frac{1 \times 10^{-3}}{4.7 \times 10^{3}} = 212.8 \text{ nA}$

b) 10 V

$i = \frac{10}{4.7 \times 10^{3}} = 2.13 \text{ mA}$

c) $4e^{-t}$ V

$i = \frac{4e^{-t}}{4.7 \times 10^{3}} = 851e^{-t} \ \mu\text{A}$

d) 100 cos(5t) V

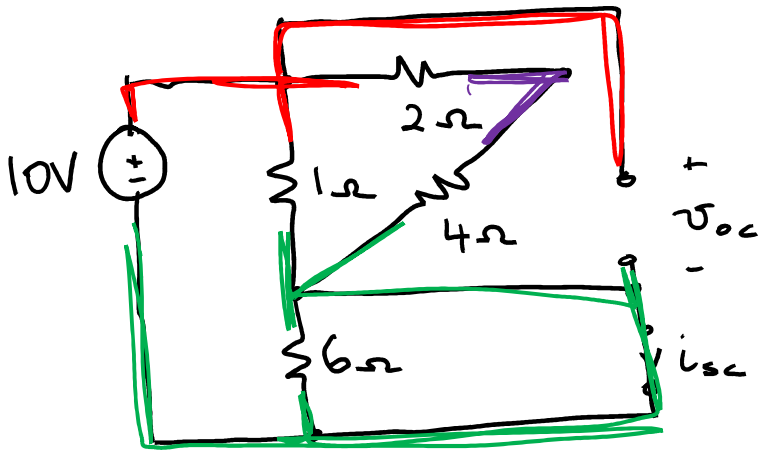
$i = \frac{100\cos(5t)}{4.7 \times 10^{3}} = 21.3\cos(5t) \text{ mA}$

e) -7 V

$i = \frac{-7}{4.7 \times 10^{3}} = -1.49 \text{ mA}$

magnitude of $i = 1.49 \text{ mA}$

KS Question 1: Parallel Components, Open Circuits, Short Circuits, Ohm's Law



For the circuit above, determine the following:

a) what (if anything) in in parallel

⇒ voltage source, 1Ω resistor and open circuit in //

⇒ 6Ω resistor & short circuit in //

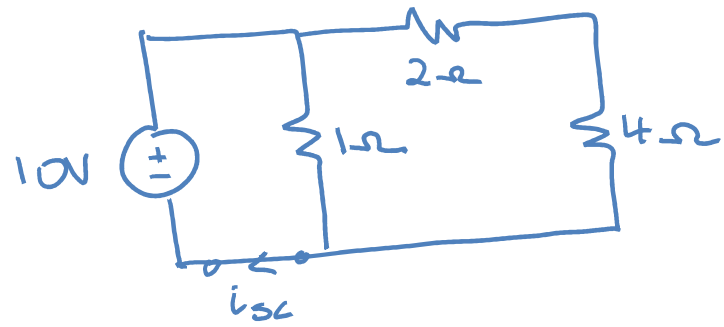
$\therefore i_{6\Omega} = 0A$

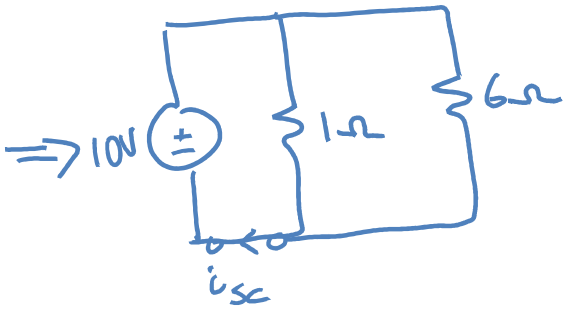
b) the voltage across the open circuit

$v_{oc} = v_{1\Omega} = v_s = 10V$

c) the current through the short circuit

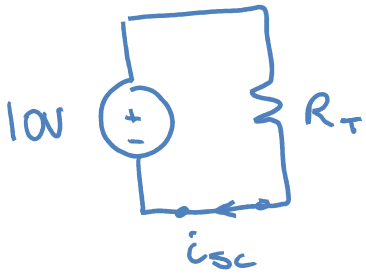
Redraw cct.





$$R_T = \frac{R_1 R_2}{R_1 + R_2}$$

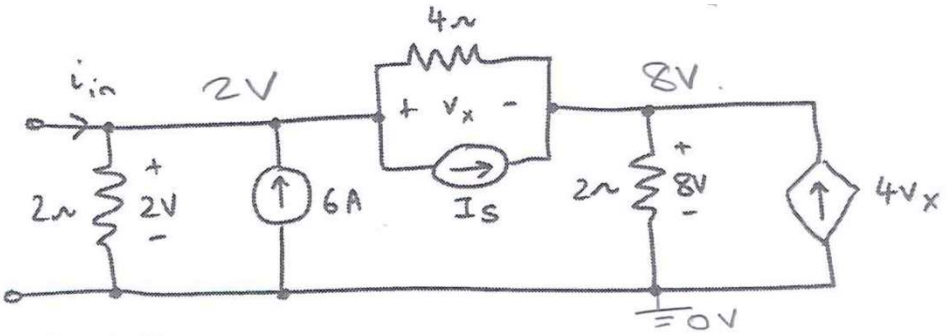
$$= \frac{1 \times 6}{1+6} = \frac{6}{7}\,\Omega$$



$$i_{sc} = \frac{v}{R_T}$$

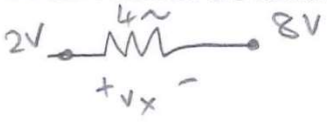
$$= \frac{10}{6/7} = 11.67\,A$$

Chapter 3 Ex 20: Ohm's and Kirchoff's laws

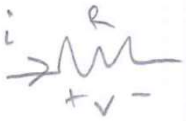


Use Ohm's and Kirchoff's laws on the circuit below to find

a) v_x



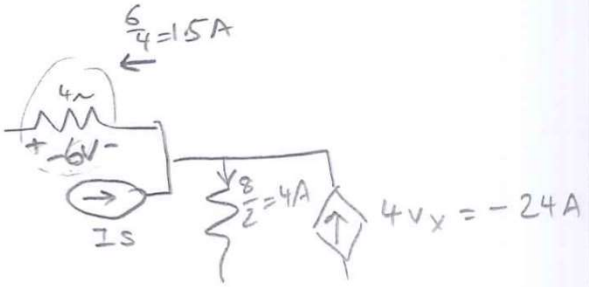
$v_x = 2 - 8 = -6V.$



b) I_s $\sum I_{in} = 0$, KCL

$I_s - 1.5 - 4 - 24 = 0$

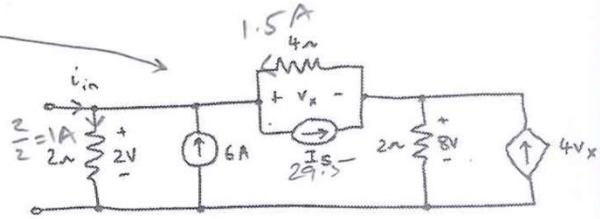
$I_s = 29.5A$



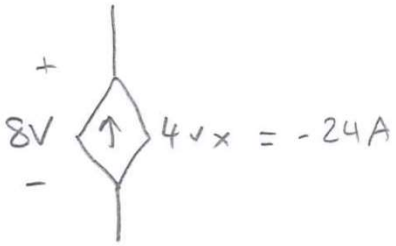
c) i_{in} $\sum I_{in} = \sum I_{out}$

$i_{in} + 6 + 1.5 = 1 + 29.5$

$i_{in} = 23A$



d) the power supplied/ provided by the dependent source.



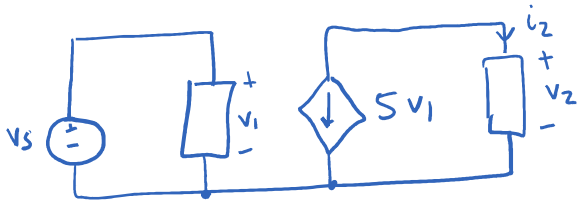
$P_{supp} = VI$

$= 8 \times (-24)$

$= -192W$

Extra Questions for Tutorial 1 (no worked solutions just final answer given)

Ch 2 ex 23 [Ans: $v_s = -1\ mV$]
For the circuit below, determine v_s if $v_2 = 1000 i_2$ and $i_2 = 5\ mA$.



Ch 2, Ex 27 [Ans: a) 4.545 mA – 5.556 mA. b) 22.73 mW – 27.78 mW]

A 1 kΩ resistor with a 10% tolerance may have a value anywhere within the range 900 - 1100 Ω. Answer the following questions assuming 5.0 V is applied across the resistor.

a) What is the range of currents that might be measured?
b) What is the range of power that might be measured?

Ch 3 ex 36 [Ans: $i_x = 571.4\ \mu A$]

Find the current i_x in the circuit below.