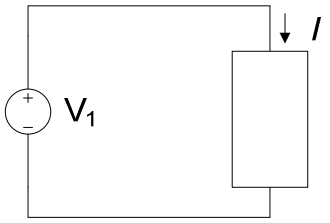
Solution Set 2 (Fall 2009)

2.1

a) $P_{ABS}=V\cdot I=6\cdot 3=18$ Watts

b) $P_{ABS}=V\cdot I=(-6)\cdot(-3)=18$ Watts



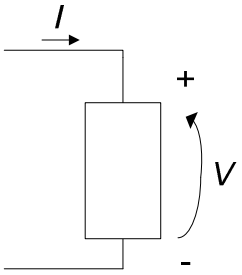
2.2

a) $P_{ABS}=V\cdot I=(-8)\cdot 5=-40$ W, $P_{SUPP}=40$ Watts

b) $P_{SUPP}= -V\cdot I=-8\cdot(-5)=40$ Watts

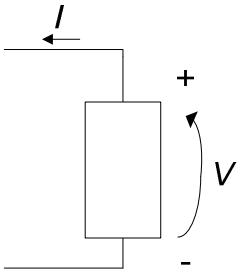
2.3

a) $P=25W=V\cdot I=5\cdot I$, $I=5A$



b) $P_{SUPP}=V\cdot I=3A\cdot 6V=18W$

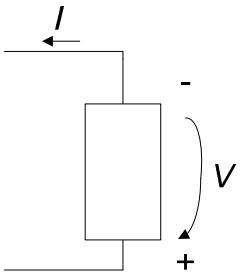
$P=-I\cdot V=-18W$ (ie. – power is supplied)



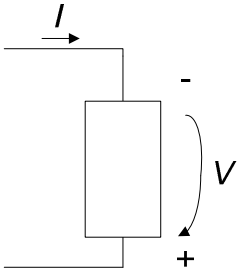
2.4

a) $P=V\cdot I=6W=(-1)I$

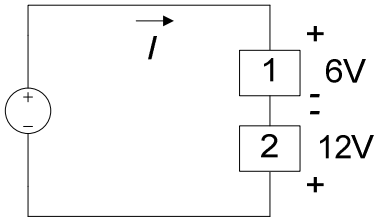
$I=-6A$



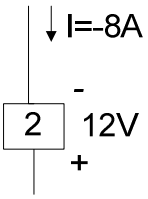
b) P=-I·V=-30W=-(-3)V
V=-10V

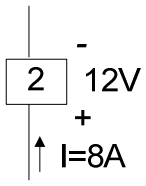


2.5 If element 1 supplies 48W:
P_1=-48=I·V=I6, I=-8A
P_2=I·V=(-8A)(-12V)=96W
So it absorbs 96W of power.



If we only take the 12V element and rearrange the signs so that they are positive:





It is clear that power is absorbed.

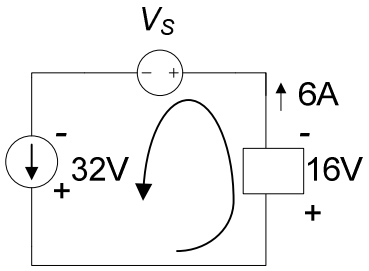
2.6 Determine the power that is absorbed or supplied by the circuit elements below:
a)
P_1=I·V=1A·5V=5W (absorbed)
P_2=V·I=1·7=7W (absorbed)
P_{12V}=V·I=12(-1A)=-12W (12W Supplied)
Note: total power supplied = total power absorbed.

b)
P_{24V}=24V(-2A)=-48W (48W supplied)
P_1=2A·8V=16W
P_{16V}=16V·2A=32W
Note: absorbs even though it is a source.

2.7
P_1=3·2=6W (absorbed)
P_{7V}=7·2=14W (absorbed)
P_{10V}=10V·2A=20W (supplied)

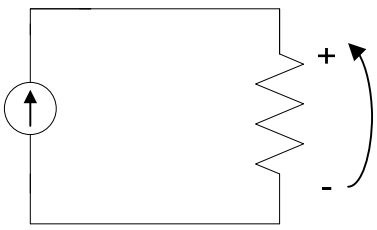
2.8
Add all power absorbed and set to 0.
$P_{6A}+P_1+P_2+P_3+P_{8V}+P_4=0$
(-6A)(6V) + (2A)(6V) + (1A)(6V) + I_X(2V) + I_X(4V) + (6V)(1A) = 0
-I_X(6V)=(-2A)(6V)
I_X=2A
So the 4V source and element 3 are actually absorbing power.

2.9
Using KVL:



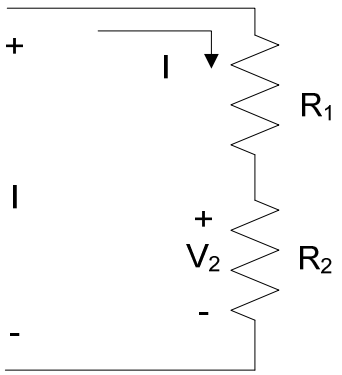
+V_S+16V-32V=0
V_S=16V
So P_{Vs}=(6A)(16V)=96W
So V_S is absorbing 96 Watts.

2.10
V_{CS}=6mA·2kΩ=12V
P_R=12V·6mA=72mW



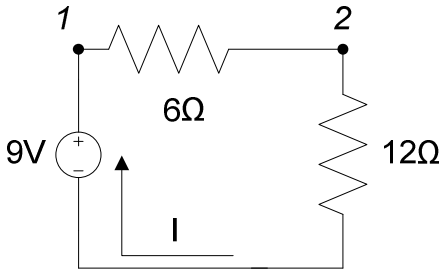
2.11
PRx=V·I=24mW=(8mA)(V)

V=3V
V=IR=8mA·R=3V
R=(3/8)kΩ



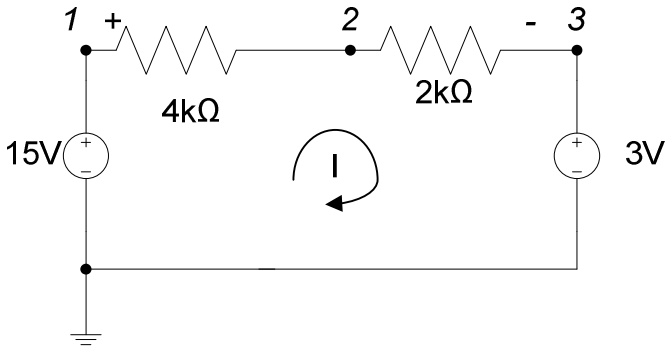
Voltage Divider: $V_2 = \frac{R_2}{R_1 + R_2} \bullet V_T$, $I = \frac{1}{R_1 + R_2} \bullet V_T$

2.12
$I=V/R_T=9V/(12+6)\Omega=1/2$ A
$V_{12}=I\cdot R=1/2\text{ A}\cdot 6\Omega = 3V$



-or- use voltage divider
$V_{12}=9V\cdot 6/(12+6) = 3V$

2.13 Find V_2 in the circuit below.

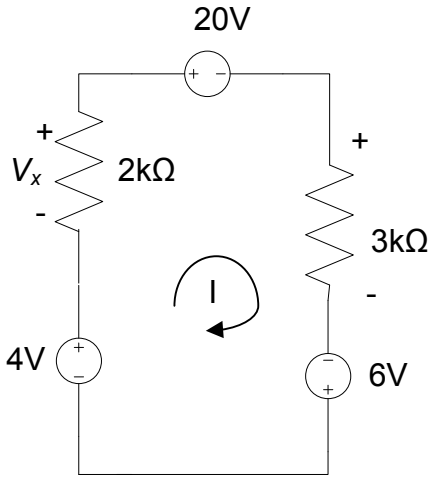


$V_{13}+3V-15V=0$
$V_{13}=12V$
$I=V_{13}/(4k+2k)=2mA$

$V_{23}=2mA\cdot 2k=4V$
-or-
$V_{23}=V_{13}\cdot 2k/(2k+4k)=4V$

$V_2=V_{23}+V_3=4V+3V=7V$

2.14 Find V_x in the circuit below.



KVL:
$-4V-V_X+20+V_{3k}-6V=0$
Note: $V_X=-I\cdot 2k$, $V_{3k}= I\cdot 3k$
$I(2k+3k)=-10V$
$I=-2mA$
So $V_X=-I\cdot 2k=-(-2mA)(2k)=4V$
$P_{4V}=-I\cdot V=-(-2)mA(4V)= 8$ mW (absorbed)