PROB. 1.14

1.14 Two electric circuits, represented by boxes A and B, are connected as shown in Fig. P1.14. The reference direction for the current i in the interconnection and the reference polarity for the voltage v across the interconnection are as shown in the figure. For each of the following sets of numerical values, calculate the power in the interconnection and state whether the power is flowing from A to B or vice versa.

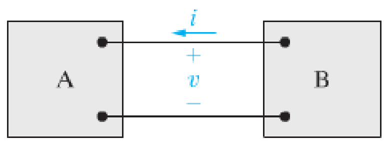
a) $i = 10$ A, $v = 125$ V

b) $i = 5$ A, $v = -240$ V

c) $i = -12$ A, $v = 480$ V

d) $i = -25$ A, $v = -660$ V

Figure P1.14



FOR THE GIVEN POLARITIES OF v & i, IF $p = v \cdot i > 0$, THEN THE POWER IS FLOWING FROB B TO A

	i(A)	v(V)	P	DIRECTION	
a	10	125	1250 W	B → A	(1.14a)
b	5	-240	-1200 W	A → B	(1.14b)
c	-12	480	-5760 W	A → B	(1.14c)
d	-25	-660	16500 W	B → A	(1.14d)

TOPS. 35500

PROB 1.26

1.26 The numerical values for the currents and voltages in the circuit in Fig. P1.26 are given in Table P1.26. Find the total power developed in the circuit.

Figure P1.26

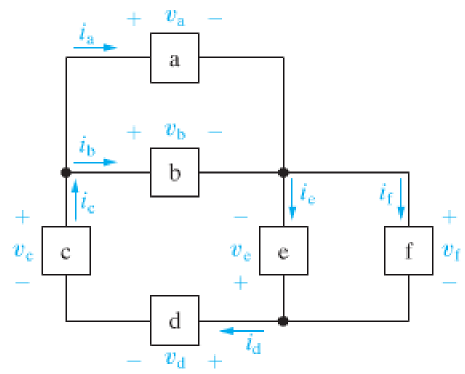


TABLE P1.26

Element	Voltage (kV)	Current (mA)
a	150	0.6
b	150	−1.4
c	100	−0.8
d	250	−0.8
e	300	−2.0
f	−300	1.2

EACH ELEMENT IS DECLARED A "SOURCE" OR "LOAD" ACCORDING TO THE RELATIVE POLARITY OF THE ASSIGNED v & i

THEN, DEPENDING ON THE SIGN OF $p = v \cdot i$, IT IS DETERMINED WHETHER IT IS ACTUALLY DEVELOPING OR ABSORBING POWER

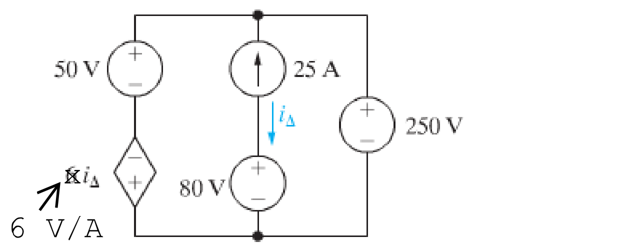
ELEMENT	TYPE	v(kV)	i(mA)	p(W)	DEVELOP(W)	ABSORB(W)
a	LOAD	150	0.6	90		90
b	LOAD	150	−1.4	−210	210	
c	SOURCE	100	−0.8	−80		80
d	LOAD	250	−0.8	−200	200	
e	SOURCE	300	−2.0	−600		600
f	LOAD	−300	1.2	−360	360	
TOTAL					770W	770 W

THE TOTAL POWER DEVELOPED BY THE CIRCUIT IS 770 W ←

PROB. 2.7

2.7 If the interconnection in Fig. P2.7 is valid, find the total power developed in the circuit. If the interconnection is not valid, explain why.

Figure P2.7



BY INSPECTION, $\Delta i = -25A$

DEPENDENT SOURCE VOLTAGE IS $(6\frac{V}{A})(-25A) = -150V$

THE VOLTAGE OF TOP NODE RELATIVE TO BOTTOM NODE

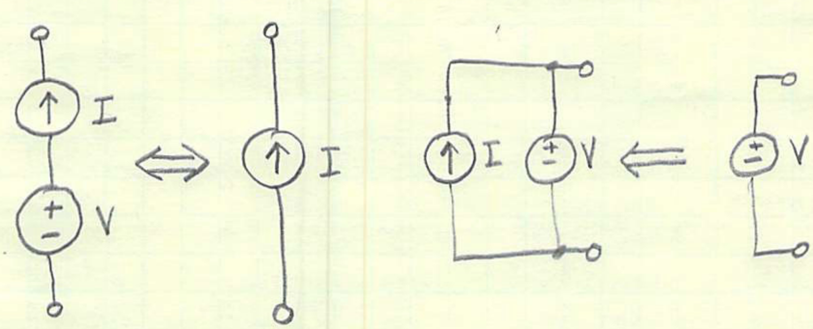
LEFT BRANCH: $50V - {}^{-}150V = 200V$

MIDDLE BRANCH: COMPLIANT DUE TO CURRENT SOURCE

RIGHT BRANCH: 250V

CIRCUIT IS NOT VALID BECAUSE THE VOLTAGE FROM THE TOP NODE TO THE BOTTOM NODE IS NOT THE SAME FOR ALL POSSIBLE PATHS, THUS VIOLATING KVL ← (2.7)

NOTE A VOLTAGE SOURCE IN SERIES WITH A CURRENT SOURE HAS NO EFFECT WHLE A CURRENT SOURCE IN PARALLEL WITH A VOLTAGE SOURCE HAS NO EFFECT.



PROB 2.21

2.21 The current i_o in the circuit in Fig. P2.21 is 1 A.

PSPICE MULTISIM

a) Find i_1.

b) Find the power dissipated in each resistor.

c) Verify that the total power dissipated in the circuit equals the power developed by the 150 V source.

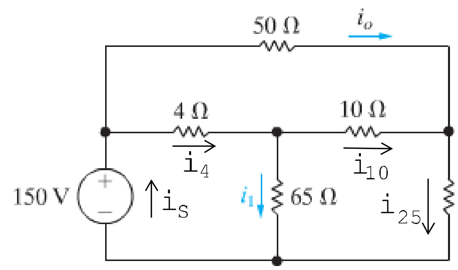


Figure P2.21

$V_C = 150V - i_o \cdot 50\Omega = 150V - (1A)(50\Omega) = 150V - 50V = 100V$

$i_{25} = \frac{V_C}{25\Omega} = \frac{100V}{25\Omega} = 4A$

$i_{10\Omega} = i_{25} - i_o = 4A - 1A = 3A$

$V_B = V_c + i_{10} \cdot 10\Omega = 100V + 3A \cdot 10\Omega = 100V + 30V = 130V$

$i_1 = \frac{V_B}{65\Omega} = \frac{130V}{65\Omega} = 2A$ ← (2.21a)

$i_4 = i_1 + i_{10} = 2A + 3A = 5A$

$V_S = V_B + i_4 \cdot 4\Omega = 130V + 5A \cdot 4\Omega = 130V + 20V = 150V$ ✓

$i_S = i_o + i_4 = 1A + 5A = 6A$

R(Ω)	i (A)	I^2R = P
4	5	$(5A)^2 \cdot (4\Omega) = 100W$
10	3	$(3A)^2 \cdot (10\Omega) = 90W$
25	4	$(4A)^2 \cdot (25\Omega) = 400W$
50	1	$(1A)^2 \cdot (50\Omega) = 50W$
65	2	$(2A)^2 \cdot (65\Omega) = 260W$
TOTAL		900W ← (2.21b)

$P_{SOURCE} = 150V \cdot 6A = 900W$ (EQUALS LOADS) ← (2.21c)