EE 2010
Electric Circuit (1)
Problems on Chapter 1

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Problem 1.18

1.18 The voltage and current at the terminals of the circuit element in Fig. 1.5 are zero for $t < 0$. For $t \geq 0$ they are

$$v = 15e^{-250t}\ \text{V},$$
$$i = 40e^{-250t}\ \text{mA}.$$

a) Calculate the power supplied to the element at 10 ms.

b) Calculate the total energy delivered to the circuit element.

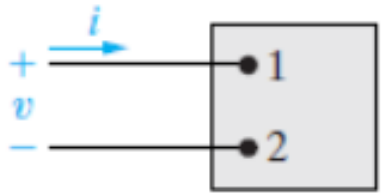


Figure 1.5 ▲ An ideal basic circuit element.

a) $p = vi = (15e^{-250t})(40\times10^{-3}e^{-250t})$

$\Rightarrow p = 0{,}6e^{-500t}\ W$

p at $t = 10ms = 0{,}6e^{-500\times10\times10^{-3}} = \boxed{4{,}04mW}$

b) $W_{total} = \int_0^\infty p(t)dt = \int_0^\infty 0{,}6e^{-500t}dt$

$\Rightarrow W = \frac{0{,}6}{-500}e^{-500t}\Big|_0^\infty = \boxed{1{,}2\ mJ}$

Problem 1.29

1.29 The numerical values for the currents and voltages in the circuit in Fig. P1.29 are given in Table P1.29. Find the total power developed in the circuit.

حلول في الواجبة الأول "Q1"

Figure P1.29

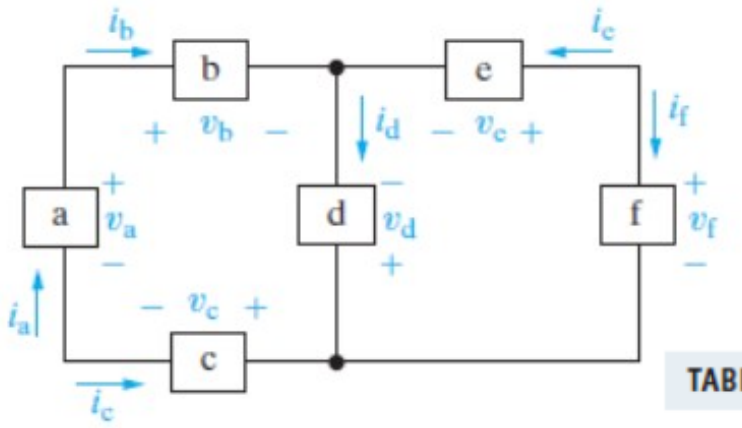


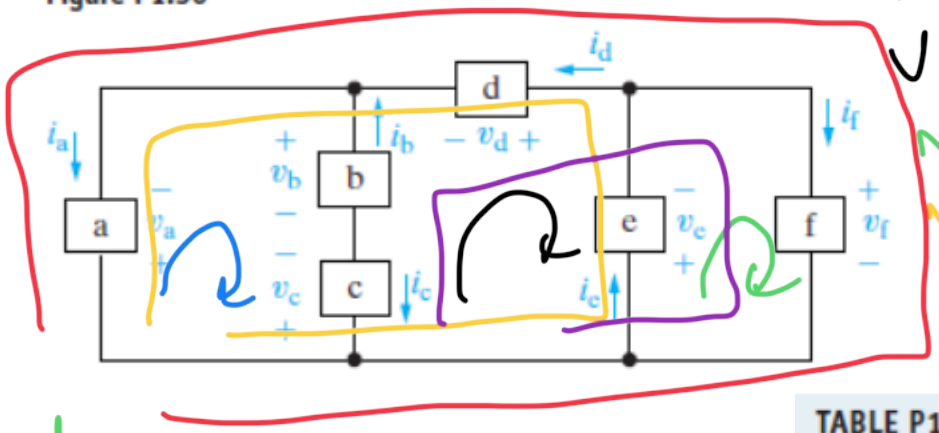
TABLE P1.29

Element	Voltage (V)	Current (mA)
a	40	−4
b	−24	−4
c	−16	4
d	−80	−1.5
e	40	2.5
f	120	−2.5

Problem 1.30

1.30 The numerical values of the voltages and currents in the interconnection seen in Fig. P1.30 are given in Table P1.30. Does the interconnection satisfy the power check?

Figure P1.30



$V_a + V_b - V_c = 0$

$V_c - V_b - V_d - V_c = 0$

$V_e + V_f = 0$

$V_a - V_d - V_c = 0$

$V_a - V_d + V_f = 0$

$V_c - V_b - V_d + V_f = 0$

$i'_b = -i'_c$

$i'_d + i'_b = i'_a$

$i'_e = i'_d + i_f$

TABLE P1.30

Element	Voltage (kV)	Current (μA)
a	−3	−250
b	4	−400
c	1	400
d	1	150
e	−4	200
f	4	50

$P_a = -i_a V_a = -(-250\mu)(-31) = -0,75W$

$P_b = -i_b V_b = -(-400\mu)(4k) = 1.6W$

$P_c = -i_c V_c = -(400\mu)(1k) = -0,4W$

$P_d = +i_d V_d = +(150\mu)(1k) = 0,15W$

$P_e = +i_e V_e = +(200\mu)(-4k) = -0,8W$

$P_f = +i_f V_f = +150\mu)(4k) = 0,2W$

$\Sigma P_{abs} = 1.6 + 0.15 + 0,2 = 1.95W$

$\Sigma P_{del} = 0,75 + 0,4 + 0,8 = 1.95W$

$\therefore \Sigma P_{abs} = \Sigma P_{del}$ ✓