

CH 1, problems: 6, 14, 15, 31, 32

1.6:

Given: Bamboo can grow 250 mm/day.
Plant cells are 10 μ m long

Find: a) length of time to grow 1 cell length
b) How many cell lengths are added in 1 week

Solution:

$$a) 10 \mu\text{m} \cdot \frac{1 \text{ day}}{250 \text{ mm}} \cdot \frac{1 \text{ mm}}{1000 \mu\text{m}} \cdot \frac{24 \text{ h}}{\text{day}} \cdot \frac{3600 \text{ s}}{\text{h}} = 3.46 \text{ s}$$

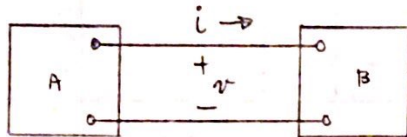
→ 3.46 s to grow 1 cell, or 10 μ m

$$b) 1 \text{ week} \cdot \frac{250 \text{ mm}}{\text{day}} \cdot \frac{7 \text{ day}}{1 \text{ week}} \cdot \frac{1000 \mu\text{m}}{\text{mm}} \cdot \frac{1 \text{ cell}}{10 \mu\text{m}} = 1.75 \cdot 10^5 \text{ cells}$$

→ 175,000 cells in one week

1.14:

Given:



Find: For values below, calculate

- 1) power in interconnection
- 2) power flow from $A \rightarrow B$ or $B \rightarrow A$

- a) $i = 6A$, $v = 30V$
- b) $i = -8A$, $v = -20V$
- c) $i = 4A$, $v = -60V$
- d) $i = -9A$, $v = 40V$

Solution:

a) $P = IV$

$P = 6A \cdot 30V$

$\rightarrow |P| = 180W$ ①
 $A \rightarrow B$ power flow ②

b) $P = -8A \cdot -20V$

$P = 160W$

$\rightarrow |P| = 160W$ ①
 $A \rightarrow B$ power flow ②

c) $P = 4A \cdot -60V$

$P = -240W$

$\rightarrow |P| = 240W$ ①
 $B \rightarrow A$ power flow ②

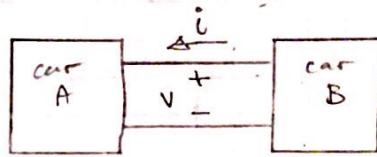
d) $P = -9A \cdot 40V$

$P = -360W$

$\rightarrow |P| = 360W$ ①
 $B \rightarrow A$ power flow

1.15

Given:



$$i = 30 \text{ A}$$
$$V = 12 \text{ V}$$

- Find:
- a) which car has a dead battery
 - b) If maintained for 1 min, how much energy is transferred?

Solution:

a) by PSC, car A has dead battery

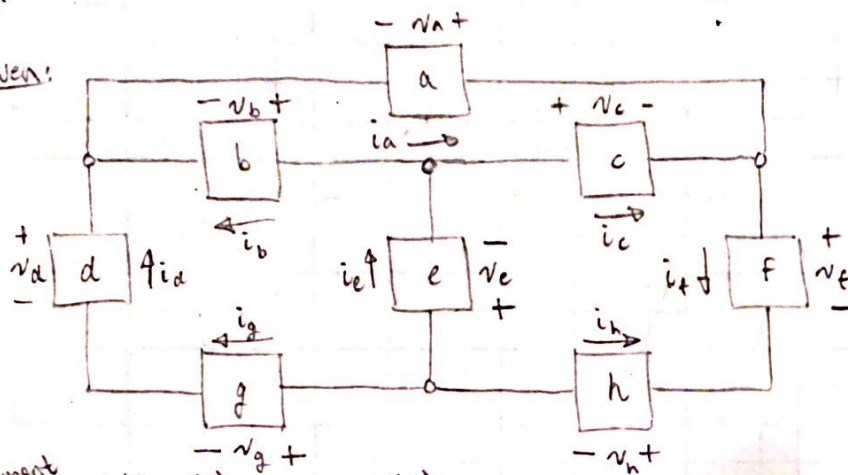
b) $P = 30 \text{ A} \cdot 12 \text{ V}$
 $P = 360 \text{ W}$, $1 \text{ W} = 1 \text{ J/s}$

$$\rightarrow E = 360 \text{ W} \cdot 1 \text{ min} \cdot \frac{60 \text{ s}}{\text{min}} = 21.6 \text{ kW} \cdot \text{s}$$

$E = 21.6 \text{ kJ}$

1.31:

Given:



element	voltage(V)	current(A)
a	46.16	6.0
b	14.16	4.72
c	-32.0	-6.4
d	22.0	1.28
e	-33.6	-1.68
f	66.0	0.4
g	2.56	1.28
h	-0.4	0.4

A subordinate says this does not pass the power check.

Find: a) Is the subordinate wrong? (i.e. does it pass the power check?)
b) If " " is correct, where is the error?

Solution:

a) power analysis:

	PSC sign	P(W)
a	-	-277.0
b	+	66.83
c	+	204.8
d	-	-28.16
e	+	56.45
f	+	26.4
g	+	3.277
h	-	0.16

← using $P = IV$ from table above

$$\rightarrow P_{tot} = 52.8 \text{ W}$$

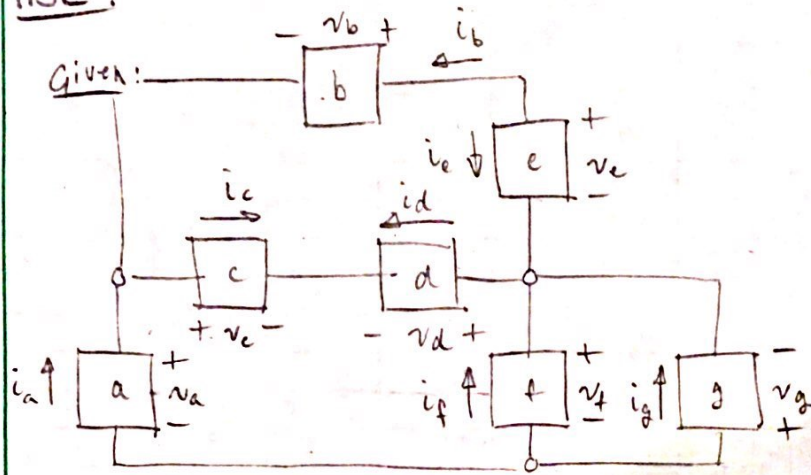
$$\neq 0$$

→ subordinate is correct

b) $\frac{52.8}{2} = 26.4 \text{ W}$ element is incorrect

→ element f is incorrect

1.32:



element	Power (kW)	Voltage (V)
a	-0.6	400
b	-0.05	-100
c	0.4	200
d	-0.6	300
e	0.1	-200
f	2.0	500
g	-1.25	-500

let (-) be supplied, (+) be absorbed

- Find:
- show that interconnections satisfy power check
 - Find current value at each element given power, current direction.

Solution:

a) $\sum P_i = 0 \rightarrow -0.6 - 0.05 + 0.4 - 0.6 + 0.1 + 2.0 - 1.25 = 0 \checkmark$

b)

element	PSC sign	current (A) ← using $I = \frac{P}{V}$
a	-	+ 1.5A
b	+	+ 0.5A
c	+	+ 2A
d	+	- 2A
e	+	- 0.5A
f	-	- 4.0A
g	+	+ 2.5A