HW1, Chapter 1

Sunday, November 15, 2009
10:59 AM

(1.1) The charge of an electron is -1.602×10^{-19} C.

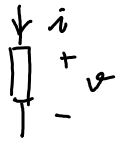
(d) The charge of 1.628×10^{20} electrons is

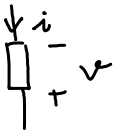
$$1.628 \times 10^{20} \left[\text{electrons}\right] \times -1.602 \times 10^{-19} \left[\frac{\text{C}}{\text{electron}}\right]$$

$$= 1.628 \times (-1.602) \times 10$$

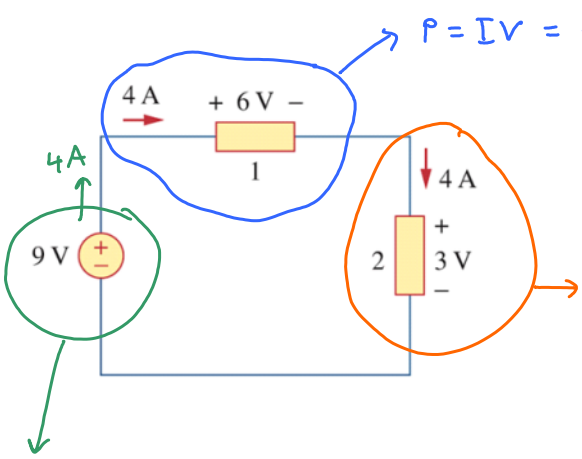
$$= \boxed{-26.08 \text{ C}}$$

(1.18) We calculate the power using the passive sign convention.

$p = iv$ 

$p = -iv$ 

(a)



$P = IV = 4 \times 6 = \boxed{24 \text{ W}}$

$p > 0$; so, absorbing power

$P = IV = 4 \times 3 = \boxed{12 \text{ W}}$

$P = -IV = -4 \times 9 = \boxed{-36 \text{ W}}$ ← $p < 0$; so, supplying power.

Again, the negative sign is here because the current flows from the negative to the positive polarity of the 9 V.

(1.22)

$$i = \frac{dq}{dt} \quad \text{and} \quad q = \int i \, dt$$

In this case, $i(t) = 30 \text{ kA}$ during the time 0 to 2 ms

If you start at time $T \neq 0$, then the endpoint will

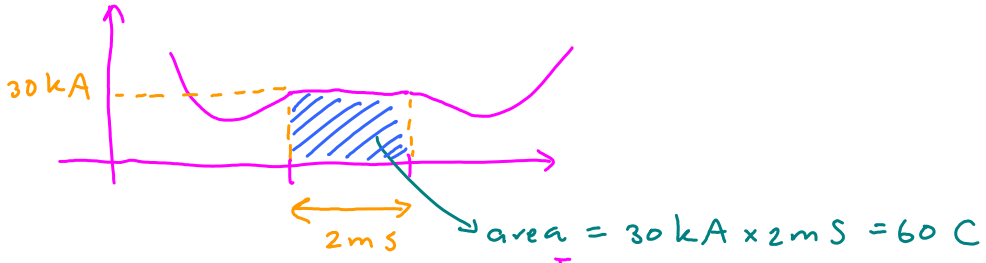
the endpoint will be T + 2mS, I choose 0 because it is easier.

So, $q_f = \int_0^{2mS} (30\,kA)\,dt = (30\,kA) \times (2mS - 0)$

(30 kA: constant)

$= 30\,kA \times 2mS = \boxed{60\,C}$ are deposited on the plane.

Another way to see this answer is to find the area under the curve of $i(t)$



Tips: when $i(t)$ is constant (as in this question) we can calculate the amount of charge by

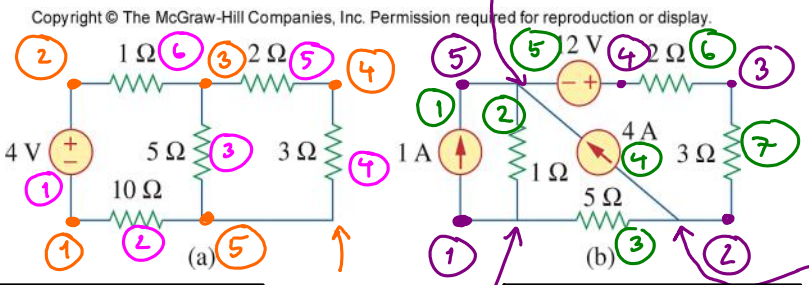
$I \times \Delta t$

(Δt: Time duration)

HW1, Chapter 2

Friday, November 13, 2009
10:18 AM

2.7



same as node (5)

* branches = 6
* nodes = 5

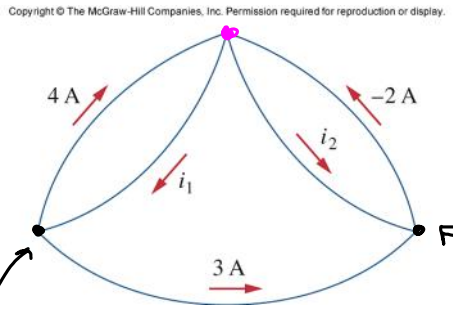
same as node (5)

same as node (1)

* branches = 7
* nodes = 5

same as node (2)

2.10



Applying KCL at this node, we have

$$4 + (-i_1) + 3 = 0$$

$$\boxed{i_1 = 7\ A}$$

Applying KCL at this node, we have

$$-2 - i_2 - 3 = 0$$

$$\boxed{i_2 = -5\ A}$$

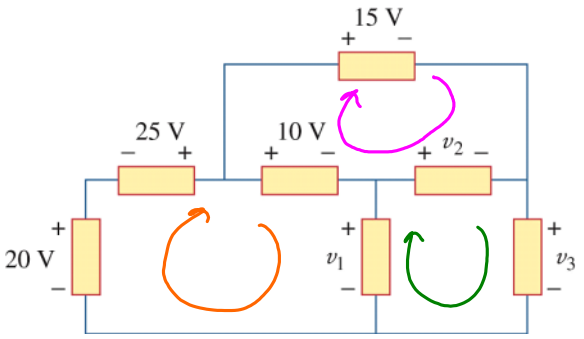
We may check the answers by applying KCL at the top node:

$$-4 + i_1 + i_2 - (-2) = 0$$

$$-4 + 7 - 5 + 2 = 0 \quad \checkmark$$

use i_1, i_2 that we know.

2.12 We will try to pick small loop with few unknown variable



This loop gives

$-10 + 15 - v_2 = 0$

$v_2 = 5\ V$

This loop gives

$-20 - 25 + 10 + v_1 = 0$

$v_1 = 45 - 10$

$v_1 = 35\ V.$

This loop says

$-v_1 + v_2 + v_3 = 0$

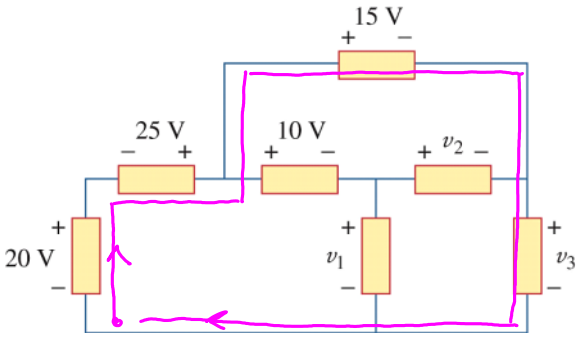
$v_3 = v_1 - v_2$

$= 35 - 5$

$v_3 = 30\ V$

Note: You may choose to work with different loops. The answers will be the same.

For example, I may choose the largest loop below:



In which case, the KVL gives

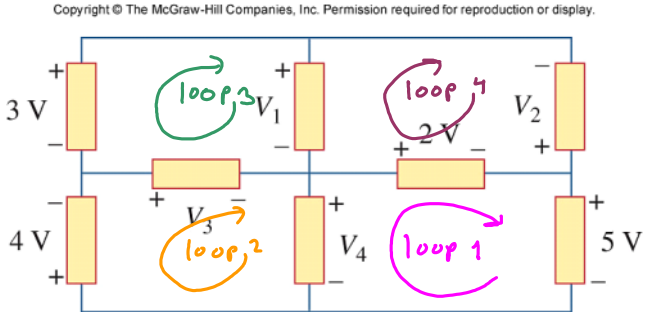
$-20 - 25 + 15 + v_3 = 0$

$v_3 = 45 - 15$

$= 30$

which is the same as what we got from a different loop earlier.

2.14



We will try to work with loop that has as few unknown variables as possible.

So, we start with "loop 1":

$-V_4 + 2V + 5V = 0$

$V_4 = 7V$

Because we already know V_4, "loop 2" now has only one unknown variable (V_3):

7V

unknown variable (V_3):

$$4 + V_3 + V_4 = 0 \quad (V_4 = 7\,V)$$

$$V_3 = -4 - V_4 = -11\ V$$

Similarly, when we know V_3, "loop 3" has only one unknown variable (V_1):

$$-3 + V_1 - V_3 = 0 \quad (V_3 = -11\,V)$$

$$-3 + V_1 + 11 = 0$$

$$V_1 = -8\ V$$

Finally, from "loop 4":

$$-V_1 - V_2 - 2 = 0 \quad (V_1 = -8\,V)$$

$$8 - V_2 - 2 = 0$$

$$V_2 = 6V$$

$V_1 = -8\,V$
$V_2 = 6V$
$V_3 = -11\,V$
$V_4 = 7V$