HW #1 Solution

1.7

$$Q = It = (30\mu A)(500ms) = 15\mu C$$

$\boxed{15\ \mu C}$ flow past in 500 ms.

1.13 $q(t) = 1 - e^{-1000t}\ \mu C$

$$i = \frac{dq}{dt} = -1000e^{-1000t}\ \mu A \quad t = 1.6094\ ms \Rightarrow \boxed{i = -499.98\ mA}$$

1.15

$$q(t) = \int_0^t i(\tau)\,d\tau = \int_0^t 5e^{-3\tau}\,d\tau = -\frac{5}{3}e^{-3\tau}\Big|_0^t$$

$$\boxed{q(t) = \frac{5}{3}(1 - e^{-3t})\ C}$$

1.25

$$i = \frac{P}{V} = \frac{40e^{-2t} \times 10^{-3}}{2e^{-t}}\ \frac{W}{V} = 20e^{-t} \times 10^{-3} A.$$

$$Q = \int_0^\infty i(\tau)\,d\tau = \int_0^\infty 20e^{-\tau} \times 10^{-3}\,d\tau = 20 \times 10^{-3}(-e^{-\tau}\Big|_0^\infty)$$

$= \cancel{20e}$ $\boxed{20\ mC}$

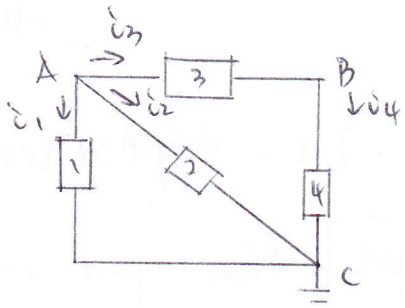
2.1

$$V = IR = (2.2\,mA)(33\,k\Omega) = \boxed{72.6\ V}$$

2.11

$$P = VI = I^2R \Rightarrow I = \sqrt{\frac{P}{R}} = \sqrt{\frac{0.25W}{10^5\,\Omega}} = \boxed{1.91\ mA}$$

2.17



a) Nodes: A, B, C.

Loops: A → B → C → A

A → C → A

b) Series: 1 & 2

Parallel: 3 & 4

c) KCL

$i_1 + i_2 + i_3 = 0$

$i_3 = i_4$

$i_1 + i_2 + i_4 = 0$

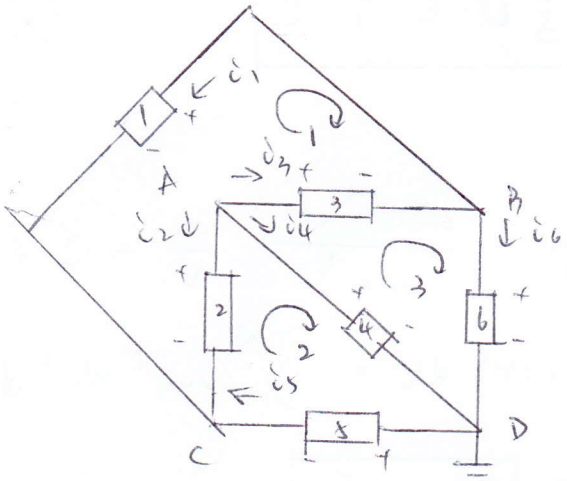
KVL

$-V_1 + V_2 = 0$

$-V_2 + V_3 + V_4 = 0$

$-V_1 + V_3 + V_4 = 0$

2.19.



a) Nodes A, B, C, D

Loops: 1 → 3 → 2 → 1,

3 → 6 → 4 → 3, 4 → 5 → 2 → 4

2 → 3 → 6 → 5 → 2, 1 → 6 → 5 → 1

b) None in series nor parallel

c) KCL $-i_2 - i_3 - i_4 = 0$, $i_5 + i_2 + i_1 = 0$

$-i_1 + i_3 - i_6 = 0$, $i_4 + i_6 - i_5 = 0$

KVL

$V_2 - V_1 - V_3 = 0$ ↻1

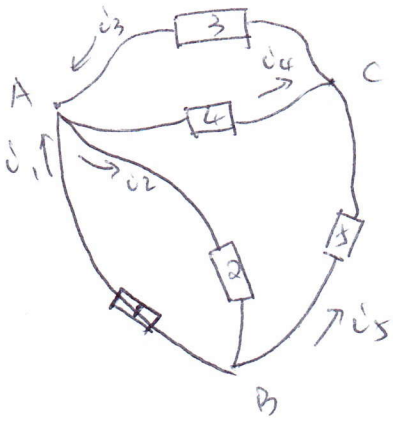
$-V_2 + V_5 + V_4 = 0$ ↻2

$V_6 - V_4 + V_3 = 0$ ↻3

2.24.

3 & 4, 1 & 2 are in parallel

no series connection.



A: $i_1 + i_3 - i_2 - i_4 = 0$

$$\boxed{i_4 = -30\ mA}$$

B: $i_2 - i_1 - i_5 = 0$

$$\boxed{i_5 = 14\ mA}$$

2.27.