16/11/06 **Electronics Homework 2(b).**

1. (1) Voltage at A = <u>6V</u>
   (2) Voltage at B = <u>0V</u>
   (3) Voltage at C = <u>3V</u>

2. (a) $R = R_1 + R_2$ (series resistors)

$= 6\Omega + 6\Omega$

$\rightarrow \underline{R = 12\Omega}$

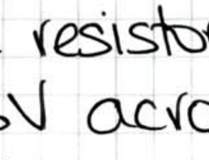
(b) Use Ohm's Law

$I = \frac{V}{R}$

$= \frac{12V}{12\Omega}$

$\rightarrow \underline{I = 1A}$

(c) Use Ohm's Law



$V = IR$

$= 1A \times 6\Omega$

$\rightarrow \underline{V = 6V}$

Both resistors are 6Ω, so 6V across each resistor.

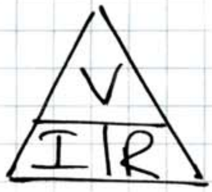
3. (a)

(a) $R = R_1 + R_2$ (series resistors)

$= 20\Omega + 30\Omega$

$\rightarrow$ $\underline{R = 50\Omega}$

(b) Use Ohm's Law

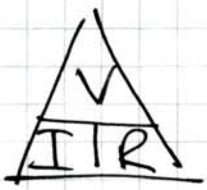


$I = \frac{V}{R}$

$= \frac{10V}{50\Omega}$

$\rightarrow$ $\underline{I = 0.2A}$

(c) Use Ohm's Law



for 20Ω resistor;

$V = IR$

$= 0.2A \times 20\Omega$

$\rightarrow$ $\underline{V = 4V}$

* in a series circuit, the same current flows through all the components

for 30Ω resistor;

$V = IR$

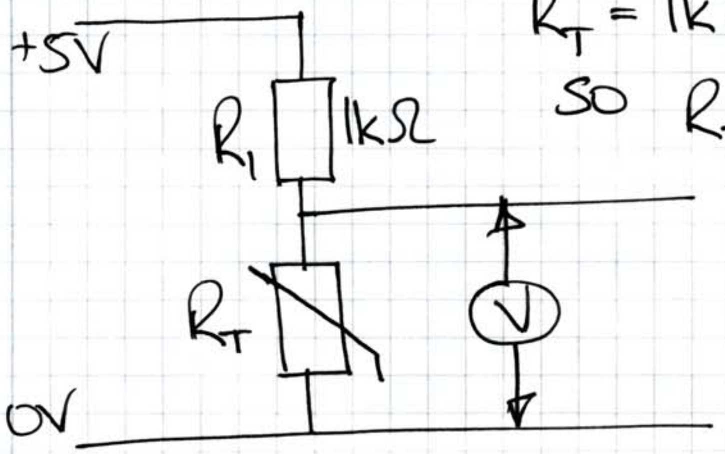
$= 0.2A \times 30\Omega$

$\rightarrow$ $\underline{V = 6V}$

(b) The ratio of the voltages across the resistors is equal to the ratio of the resistances themselves.

$$\left[\text{or} \quad \frac{R_1}{R_2} = \frac{V_1}{V_2} \right]$$

4\. (a)



At room temperature, $R_T = 1k\Omega$,

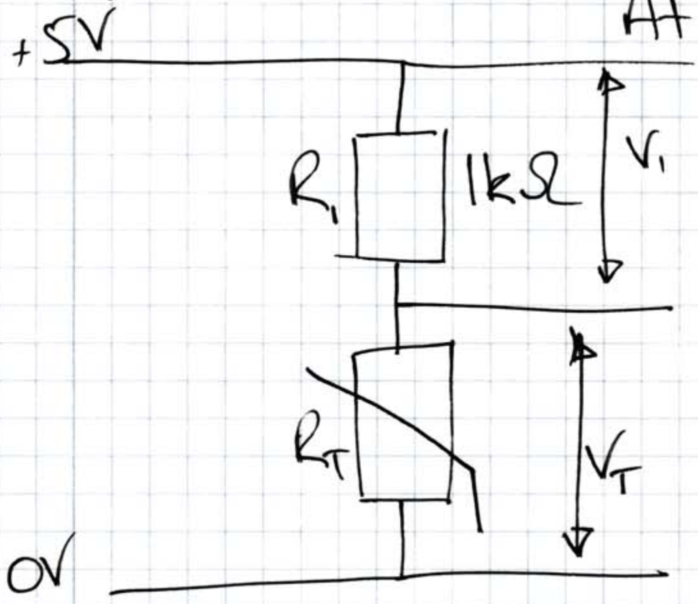
so $R_T = R_1 = 1k\Omega$.

This means V is at midpoint between 5V and 0V (same as point C in Q1)

i.e. $\underline{V = 2 \cdot 5V}$

4(b)

At 100°C, $R_T = 100\Omega$



$$\frac{V_1}{V_T} = \frac{R_1}{R_T} = \frac{1000\Omega}{100\Omega} = 10.$$

so $\frac{V_1}{V_T} = 10$

$\rightarrow V_1 = 10V_T$

but $V_1 + V_T = 5V$ (all the voltages must add up to the supply voltage)

so $10V_T + V_T = 5V$

$11V_T = 5V$

so $V_T = \frac{5V}{11}$

$\rightarrow$ $\underline{V_T = 0.45V}$

5\. (a) The longest charging time is obtained when

$R = 1M\Omega$ and $C = 100\mu f$

(b) The shortest charging time is obtained when

$R = 10K\Omega$ and $C = 10\mu f$.

(c) These results show that the time taken to charge a capacitor are dependent on both the capacitance of the capacitor and the size of the series resistance.

The larger the capacitance, the longer the time required to charge the capacitor.

The greater the series resistance, the longer the time to charge the capacitor.