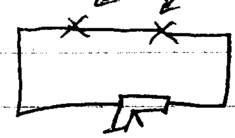
Physics 132 HW III

Session III.1

capillaries, or other flow restriction

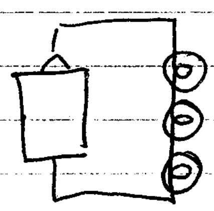
1) a)



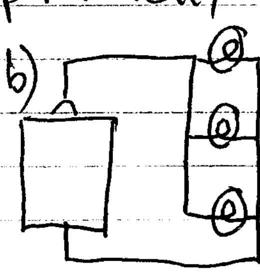
b) If a constant flow source, then same flow through 2 in series as for a single bulb, since same current flows through each bulb, and total flow is unchanging.

If a constant pressure source, then less flow through 2 in series than for single bulb. Pressure drops across each capillary/bulb must add up to total pressure pump supplies, which is a constant. So ΔP across an individual bulb ~~[illegible]~~ decreases when a second bulb is added, and current therefore decreases proportionally

2) a)



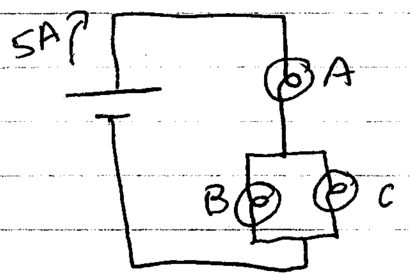
b)



c) Type a) is cheaper – since only one wire goes from one bulb to the next.

Session III.2

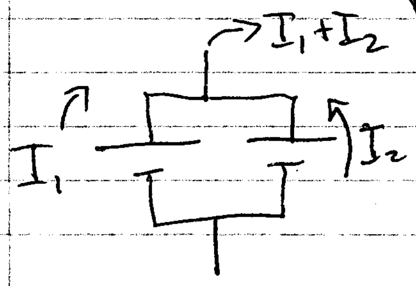
1)



All of current goes throug A (5A)

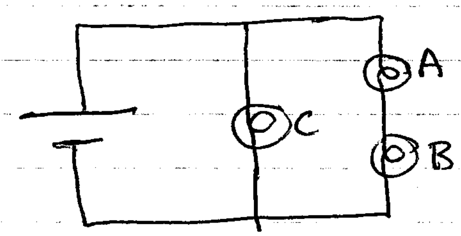
Current is split evenly between B & C (2.5A each)

2) If I have two constant current sources, & I want currents to add they must be combined in parallel:



Otherwise, in series, best possible result is greatest of I_1 & I_2, & more likely some value in between

3)



a) ΔV across C is V_{batt}

ΔV across A + ΔV across B $= V_{batt}$

So $C > A = B$

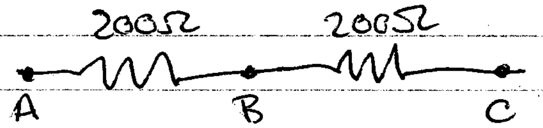
since identical & in series

b) A single bulb would have $\Delta V = V_{batt}$, which is $= C$. A & B dim relative to this.

Session III.3

1) $200\Omega = R$ $\quad I = 50mA = .05A$

$\Delta V = ?$ $\quad \Delta V = IR = .05A \times 200\Omega \boxed{= 10V}$

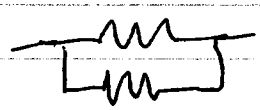
2) 

$\rightarrow .05A$

a) $\Delta V_1 = V_B - V_A = IR = 10V$

b) $\Delta V_2 = V_C - V_B = IR = 10V$, so $\Delta V_{total} = V_C - V_A = \Delta V_1 + \Delta V_2 = 20V$

c) $\dfrac{\Delta V_{tot}}{I} = \dfrac{20V}{.05A} = 400\Omega$

3) 

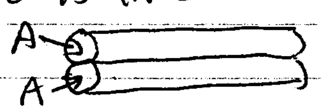
ΔV = same as original $= 10V$

a) $I_2 = \dfrac{\Delta V}{R} = .05A$

b) $I_{tot} = I_1 + I_2 = .1A$ $\quad R = \dfrac{\Delta V}{I} = \dfrac{10V}{.1A} = 100\Omega$

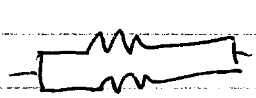
In general, 2 identical R's in parallel $\rightarrow R_{eff} = \frac{R}{2}$

c) Twice area is like



which is $\frac{R}{2}$

or



Session III.3

3d) $R = \frac{\rho l}{A}$

For Cu wire, $\rho = 1.7 \times 10^{-8}\ \Omega m$

We assume diam = 1mm, so $r = .0005m$

and $A = \pi r^2 = 7.85 \times 10^{-7}\ m^2$

$l = 30m$, so

$$R = \frac{1.7 \times 10^{-8}\ \Omega m \cdot 30m}{7.8 \times 10^{-7}\ m^2} = .65\ \Omega$$