

#1 (a.)  $V = IR$   
 $\therefore \boxed{I = \frac{V}{R}}$

(b.)  $V = IR$   
 $\therefore \boxed{R = \frac{V}{I}}$

#2  $I = \frac{dq}{dt} = I_0 e^{-t/\tau}$

$\therefore q = I_0 \int_0^t e^{-t'/\tau} dt' = -I_0 \tau e^{-t'/\tau} \Big|_0^t$

So, for all parts (a.), (b.), (c.), and (d.)

$\boxed{q = I_0 \tau (1 - e^{-t/\tau})}$

#3 Battery is rated with a total charge  $Q$  in A.hrs.

The energy stored in the battery is  $U = QV$  where  $V = 12.0V$ .

For both parts (a.) and (b.),  $P = \frac{dU}{dt} \Rightarrow t = \frac{\Delta U}{P_b} = \frac{U - 0}{P_b}$

$\therefore \boxed{t = \frac{QV}{P_b}}$

#4 (a.)  $p = \frac{m_e}{Nq^2 \langle \tau \rangle}$  where  $q = |e| = 1.602 \times 10^{-19} C$   
 and  $m_e = 9.109 \times 10^{-31} Kg$

$\therefore \boxed{\langle \tau \rangle = \frac{m_e}{N p e^2}}$

(b.) By definition,  $\boxed{R = \rho \frac{L}{A}}$

#5  $I = \frac{dq}{dt}$  where  $q$  oscillates around the nucleus at an angular frequency of  $\omega = \frac{v}{r}$ . Also,  $|q| = |e^-| \Rightarrow I = \frac{|e^-| \omega}{2\pi}$

$$\therefore \boxed{I = \frac{ev}{2\pi r}}$$


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#6 (a.)  $V_1 = I_1 R_1 \therefore \boxed{I_1 = \frac{V_1}{R_1}}$

(b.)  $P_1 = I_1 V_1 \therefore \boxed{P_1 = \frac{V_1^2}{R_1}}$

(c.)  $P_2 = I_2 V_2 \therefore \boxed{I_2 = \frac{P_2}{V_2}}$

(d.)  $P_2 = \frac{V_2^2}{R_2} \therefore \boxed{R_2 = \frac{V_2^2}{P_2}}$

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#7  $R = \frac{V}{I} = \int_{r_1}^{r_2} \frac{\rho}{2\pi L r} dr = \frac{\rho}{2\pi L} \ln\left(\frac{r_2}{r_1}\right)$

$$\therefore \boxed{\rho = \frac{2\pi L V}{I \ln\left(\frac{r_2}{r_1}\right)}}$$


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#8 For both parts (a.) and (b.),  $V = IR$

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

$$\therefore \boxed{R = \frac{V}{I_0 (e^{eV/kT} - 1)}}$$