Phys102 (Sec # 41) Quiz # 8 (Ch. ~~23&24~~ 25/26)

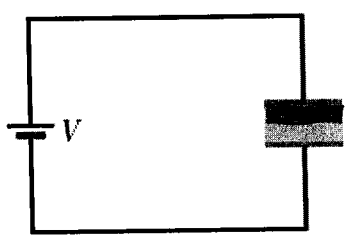
Name: (Key) ID #

1- In one hour, how many electrons pass between the terminals of a 12-V car battery when a 96 watts headlight is used? (Ans: 1.8*10**23 electrons.)

$$q = I t = \frac{P}{V} t = \frac{96\ \text{J/s}}{12\ \text{V}} (3600\ \text{s}) = 28800\ \text{C}$$

$$\#\ \text{of}\ e^- = \frac{q}{e} = \frac{28800}{1.6 \times 10^{-19}} = 1.8 \times 10^{23}\ \text{electrons}$$

2- In the figure, the parallel plate capacitor of plate area 2 x 10^{-2} m^2 is filled with two dielectric slabs, each of thickness 2 mm. One slab has dielectric constant of 3 and the other 4. How much charge does a 7-V battery store on the capacitor?



We may think of this as two capacitors in series C_1 and C_2, the former with the $\kappa_1 = 3.00$ material and the latter with the $\kappa_2 = 4.00$ material. Upon using Eq. 25-9, Eq. 25-27 and then reducing C_1 and C_2 to an equivalent capacitance (connected directly to the battery) with Eq. 25-20, we obtain

$$C_{eq} = \left(\frac{\kappa_1 \kappa_2}{\kappa_1 + \kappa_2}\right)\frac{\varepsilon_0 A}{d} = 1.52 \times 10^{-10}\ \text{F} \quad .$$

Therefore, $q = C_{eq} V = 1.06 \times 10^{-9}$ C.