

Spring Quarter 1981

May 15, 1981

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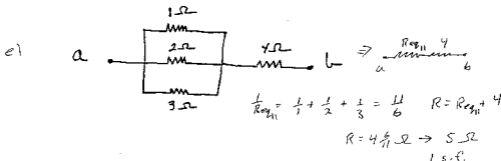
Roshko

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Shastry

PROBLEM 1A

- (a) Given a simple circuit consisting of a resistance of 15×10^4 ohms and a capacitance of 6.0 pf, find the time constant. $\tau = RC = 15 \times 10^4 \Omega \times 6.0 \times 10^{-12} \text{ F}$
- (b) Given an RC circuit. The capacitance begins to discharge at $t = 0$. If the charge on the capacitor is $3.0 \times 10^{-9} \text{ C}$ at $t = 0$, what is it at $t = 2RC$? $Q = Q_0 e^{-t/RC} = (3.0 \times 10^{-9} \text{ C}) e^{-2} = 4.06 \times 10^{-10} \text{ C} \rightarrow 4 \times 10^{-10} \text{ C}$
- (c) A current of 1.5 amperes passes through a resistance of 100 ohms. What is the power dissipated? $P = I^2 R = (1.5 \text{ A})^2 (100 \Omega) = 225 \text{ W} \rightarrow 2.2 \times 10^2 \text{ W}$
- (d) Bismuth has an atomic mass of 209.0. If it has 3.0×10^{17} charge carriers per cm^3 , how many charge carriers per atom does it have? $1.6 \times 10^{-6} \text{ carriers/atom}$
- (e) Calculate the effective resistance between points a and b. 5Ω
and a density of 9.80 gm/cm^3 points



d) $3.0 \times 10^{17} \frac{\text{carriers}}{\text{cm}^3} \times \frac{1 \text{ cm}^3}{6.4 \text{ gm}} \times \frac{209 \text{ gm}}{\text{mole}} \times \frac{1 \text{ mole}}{6.022 \times 10^{23} \text{ atoms}} =$

9.80

$1.6 \times 10^{-6} \frac{\text{carriers}}{\text{atom}}$

1.06×10^{-5}