



Name (Print) GRADER: McDONALD Name (Sign) AVE ~ 12

Discussion Instructor (CIRCLE ONE): Crelly Kao Luty McDonald Pollard

Discussion Section #: _____ Saffer Schweizer Smith

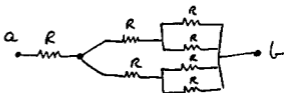
SHOW ALL WORK!! Report all numbers to three significant figures!
Use the conversion constants and data given on the front page.

(a) A current of 150 A is flowing in an aluminum wire of diameter 2.00 mm.

Aluminum has three free electrons per atom, and atomic mass of 27.0, and a density of $2.7 \times 10^3 \text{ kg/m}^3$. Find the drift velocity. $v_d = 1.65 \times 10^{-3} \text{ m/s}$

(b) Find the effective resistance between a and b. All resistors have the same value.

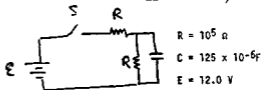
$R_{\text{eff}} = 7R/4$



Answer (c) In a magnetic field of 1.25 T find the radius of the circular motion for electrons whose energy is 2250 eV. $R = 1.28 \times 10^{-4} \text{ m}$

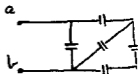
(d) In the circuit shown the switch is closed for a long time, and then opened. Find the charge on the capacitor 6.00 sec after the switch is opened.

$Q = 464 \mu\text{C}$



(e) Calculate the effective capacitance

between a and b if all capacitors have the value of 175 pF. $C_{\text{eff}} = 280 \text{ pF}$

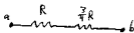
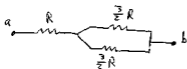
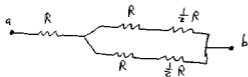
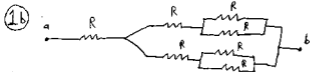


Grader:
McDonald

$$(1a) \quad I = nevdA \quad ; \quad n = \left(\frac{e's}{atom} \right) \left(\frac{atoms}{mole} \right) \left(\frac{mole}{gm} \right) \left(\frac{gm}{cm^3} \right) \left(\frac{10^2 cm}{m} \right)^3$$
$$vd = \frac{I}{neA} \quad ; \quad n = \underline{\underline{1.81 \times 10^{29} e^-/m^3}}$$

$$vd = \frac{150 amp}{(1.81 \times 10^{29} e^-/m^3) (1.602 \times 10^{-19} C/e^-) (\pi (0.004)^2)}$$

$$vd = 1.65 \times 10^{-3} m/s$$



$$R_{eq} = \frac{7}{4} R$$

(1c)

$$KE = 2250 \text{ eV} = \frac{1}{2} m v^2$$

$$v = \sqrt{\frac{2(2250)(1.602 \times 10^{-19} \text{ J/eV})}{m}}$$

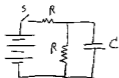
$$R = \frac{m v}{e B} = \frac{m \sqrt{\frac{2(2250 \text{ eV})(1.602 \times 10^{-19} \text{ J/eV})}{m}}}{e B} ; e = 1.602 \times 10^{-19} \text{ C/e}$$

$$= \frac{1}{B} \sqrt{\frac{2(2250 \text{ eV}) m}{1.602 \times 10^{-19}}}$$

$$R = \frac{1}{1.25 \text{ T}} \sqrt{\frac{2(2250 \text{ eV})(9.11 \times 10^{-31} \text{ kg})}{1.602 \times 10^{-19}}}$$

$$R = 1.28 \times 10^{-4} \text{ m}$$

1d

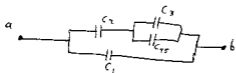
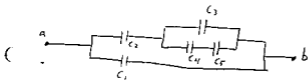
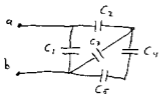


$$q = CV(e^{-t/RC})$$

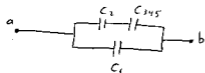
$$q = (125 \mu F)(6V)(e^{-6/12.5})$$

$$q = 464 \mu C$$

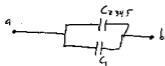
1e



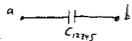
$$C_{45} = \frac{C_4 C_5}{C_4 + C_5}$$



$$C_{345} = C_3 + C_{45}$$



$$C_{2345} = \frac{C_2 C_{345}}{C_2 + C_{345}}$$



$$C_{12345} = C_1 + C_{2345} = C_{eq}$$

$$C_{eq} = 280 pF$$