生機系電工學第一次練習 2012/09/19

學號：_____ 姓名：_____

1. For a current of 1 mA, how many electrons will pass a particular point in the circuit in 1 s ?

每個電子帶 1.6×10^{-19}Coulombs，相對之下，每個 coulomb 含有 6.242×10^{18} 個電子。

所以，

$$1\times10^{-3}\text{C}\times\frac{6.242\times10^{18}\text{elctrons}}{1\text{C}}=6.24210^{15}\text{elctrons}$$

2.What is the area in circular mils of wires having diameter of 1/32 in?

$$d=\frac{1}{32}\text{in}=0.03125\text{in}\qquad d_{mils}=31.25\text{mils}\qquad A_{CM}=(d_{mils})^2=976.56\text{CM}$$

3.What is the diameter in inches of wires having the area of 625 CM ?

$$d_{mils}=\sqrt{625\text{CM}}=25\text{mils}\qquad d=0.025\text{in}$$

4.Determine the resistance of 50 ft of 1/16-in. diameter copper wire. The resistivity of copper is $10.37\,\text{CM}-\Omega/\text{ft}$

先求 1/16in 為多少 ACM？

$$d_{mils}=62.5\text{mils}\qquad A_{CM}=(d_{mils})^2=3{,}906.25\text{CM}$$

$$R=\rho\frac{\ell}{A}=(10.37\text{CM}-\Omega/\text{ft})\frac{(50\text{ft})}{3{,}906.25\text{CM}}=132.74\text{m}\Omega$$

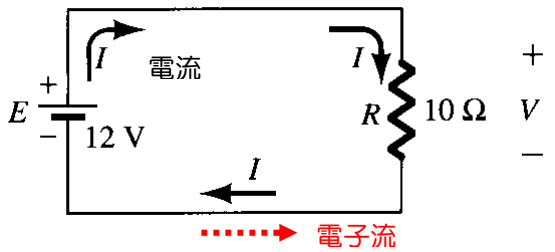
5. If the resistance of a copper conductor is 2Ω at room temperature (T = 20°C), what is its resistance at 100°C (the boiling point of water)? The inferred absolute temperature of copper is -234.5°C.

$$\frac{T+t_1}{R_1}=\frac{T+t_2}{R_2}\qquad\frac{234.5+20}{2\Omega}=\frac{234.5+100}{R_2}\qquad R_2=\frac{334.5(20)}{254.5}=2.63\Omega$$

6. (a) Determine the resistance of a modeled composition resistor with the following color bands: red, red, brown, gold. (b) Indicate its expected range of values.

(a) Resistance is 220Ω±5%　(b) Expected range of values: 209Ω~231Ω

7. 請在下面電路圖上標示電流方向、電子流方向、電壓源與電阻的極性。



8.

a. A 2.2-hp motor has an input power demand of 2,400 W. Determine its efficiency.

b. If the applied voltage is 120 V, find the input current.

c. What is the power lost in the energy transfer (in watts)?

a. $\eta = \dfrac{P_o}{P_i} = \dfrac{(2.2\text{hp})(746\text{W/hp})}{2{,}400\text{W}} \times 100\% = 68.4\%$

b. $P_i = EI \qquad I = \dfrac{P_i}{E} = \dfrac{2{,}400\text{W}}{120\text{V}} = 20\text{A}$

c. Power lost $= P_i - P_o = 2400\text{W} - 1641\text{W} = 759\text{W}$