第十九章　稳恒电流和电路

19.1 解：（1）　　$P_{总}=U_{额}I=40\times5=200\ \mathrm{W}$

（2）　　$P_{热}=I^2r=5\times5\times1=25\ \mathrm{W}$

（3）　　$P_{机}=P_{总}-P_{热}=200-25=175\ \mathrm{W}$

19.2 解：设电流方向如图 19.2 所示，网孔回路方向如图所示，由回路方程

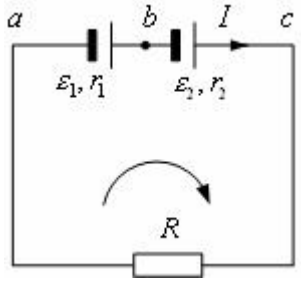

图 19.2

$$-\varepsilon_1+Ir_1-\varepsilon_2+Ir_2+IR=0$$

$$I=\frac{\varepsilon_1+\varepsilon_2}{r_1+r_2+R}=\frac{16}{3+1+4}=2\ \mathrm{A}$$

（1）　$U_{ab}=-\varepsilon_1+Ir_1$

$$=-6+2\times3=0\ (\mathrm{V})$$

（2）　　$U_{ac}=-\varepsilon_1+Ir_1-\varepsilon_2+Ir_2$

$$=-6+2\times3-10+2\times1=-8\ (\mathrm{V})$$

（3）　　$U_{cb}=\varepsilon_2-Ir_2=10-2\times1=8\ (\mathrm{V})$

19.3 解：取电流方向和网孔回路巡行方向如图 19.3 所示

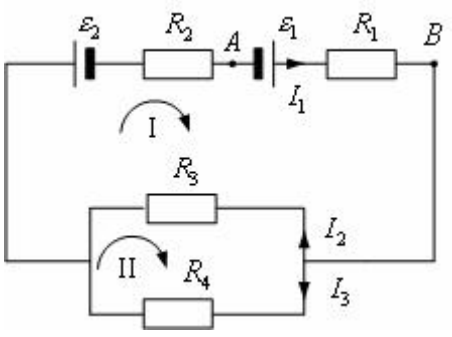

图 19.3

$$\begin{cases}-I_1+I_2+I_3=0\\ \varepsilon_2+I_1R_2-\varepsilon_1+I_1R_1+I_2R_3=0\\ -I_2R_3+I_3R_4=0\end{cases}$$

$\Rightarrow$　$I_1=\frac{28}{33}\ \mathrm{A}\quad 0.85\ \mathrm{A}$　　通过 R_1 和 R_2 的电流

$I_2=\frac{16}{33}\ \mathrm{A}\quad 0.48\ \mathrm{A}$　　通过 R_3 的电流

$I_3=\frac{4}{11}\ \mathrm{A}\quad 0.36\ \mathrm{A}$　　通过 R_4 的电流

$$U_{AB}=-\varepsilon_1+I_1R_1$$

$$=-6+\frac{28}{33}\times1=5.15\ \mathrm{V}$$

19.4 解：（1）选择回路巡行方向和电流方向如图 19.4

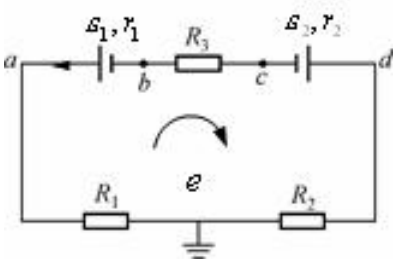

图 19.4

$$\therefore \quad \varepsilon_1 - Ir_1 - IR_3 - \varepsilon_2 - Ir_2 - IR_2 - IR_1 = 0$$

$$I = \frac{\varepsilon_1 - \varepsilon_2}{r_1 + r_2 + R_1 + R_2 + R_3} = \frac{18}{9} = 2\ \text{A}$$

（2） $U_{ae} = IR_1 = 2 \times 2 = 4\ \text{V}$

$$U_{ae} = U_a - U_e$$

$$U_a = U_{ae} + U_e = 4 + 0 = 4\ \text{V}$$

$$U_{be} = -\varepsilon_1 + Ir_1 + IR_2 = -24 + 2 \times 2 + 2 \times 2 = -16\ \text{V}$$

$$U_b = U_{be} + U_e = -16 + 0 = -16\ \text{V}$$

$$U_{bc} = -IR_3 = -2 \times 3 = -6\ \text{V}$$

$$U_b - U_c = U_{bc}$$

$$U_c = U_b - U_{bc} = -16 + 6 = -10\ \text{V}$$

$$U_{cd} = -\varepsilon_2 - Ir_2 = -6 - 2 \times 1 = -8\ \text{V}$$

$$U_d = U_c - U_{cd} = -10 + 8 = -2\ \text{V}$$

（3） $U_{ab} = \varepsilon_1 - Ir_1 = 24 - 2 \times 2 = 20\ \text{V}$

$$U_{dc} = \varepsilon_2 + Ir_2 = 6 + 2 \times 1 = 8\ \text{V}$$

19.5 解：电流方向和回路巡行方向如图 19.5

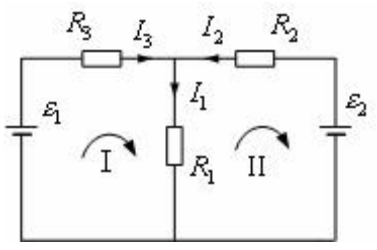

图 19.5

$$\begin{cases} I_1 - I_2 - I_3 = 0 \\ -\varepsilon_1 + I_3 R_3 + I_1 R_1 = 0 \\ -I_2 R_2 + \varepsilon_2 - I_1 R_1 = 0 \end{cases}$$

$$\Rightarrow \quad \begin{cases} I_1 = I_2 + I_3 \\ 4I_1 + 3I_3 = 2 \\ 4I_1 + 2I_2 = 1 \end{cases}$$

$$\Rightarrow \quad \begin{cases} I_1 = \dfrac{7}{26}\ \text{A} \\ I_2 = -\dfrac{1}{26}\ \text{A} \\ I_3 = \dfrac{4}{13}\ \text{A} \end{cases}$$

$$P_1 = I_3\varepsilon_1 = \frac{4}{13}\times 2 = \frac{8}{13}\ \text{W}$$

$$P_2 = I_2\varepsilon_2 = -\frac{1}{26}\times 1 = -\frac{1}{26}\ \text{W}$$