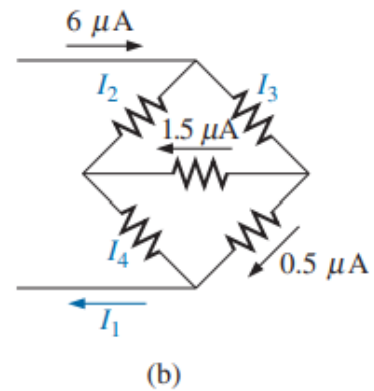
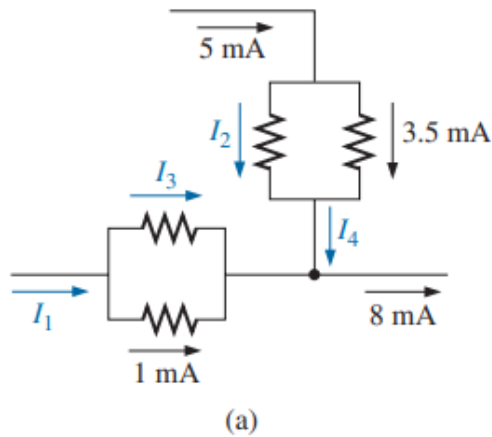
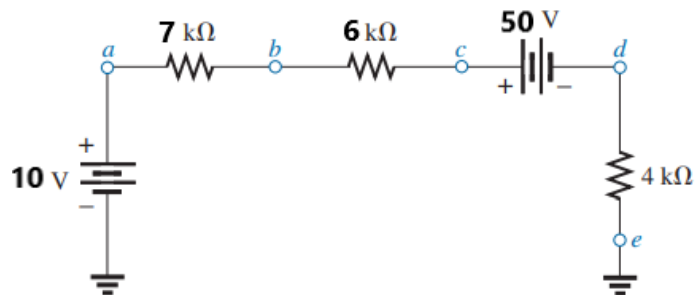


**Mandatory Questions: You have to answer all the questions from question no 1 to 6.**

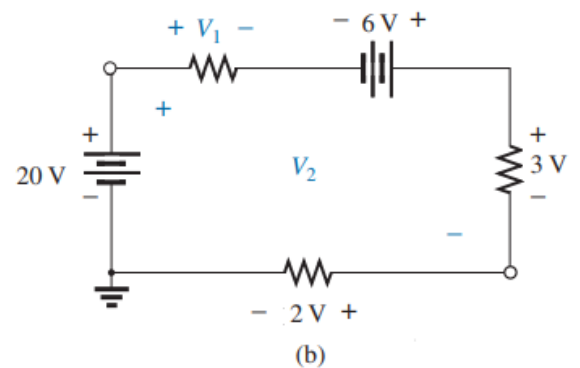
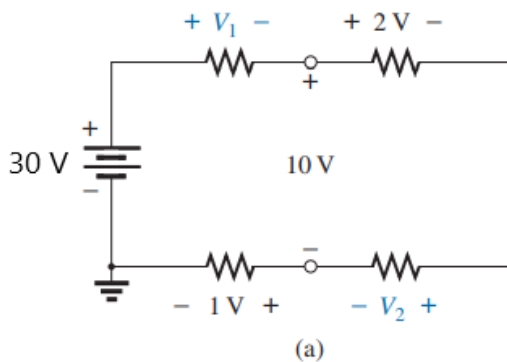
**1. Using Kirchhoff's current law, determine the unknown currents  $I_1$ ,  $I_2$ ,  $I_3$ ,  $I_4$  for the following two networks. [5]**



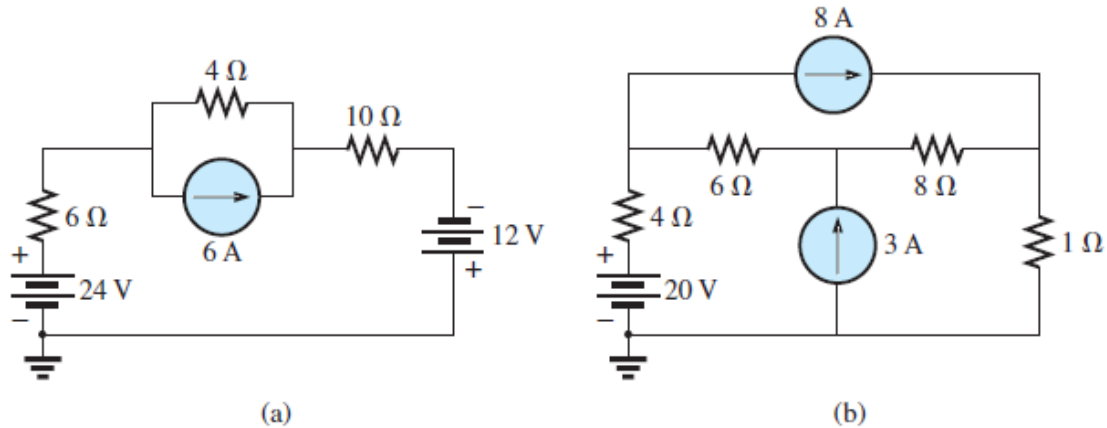
**2. Determine the voltages:  $V_a$ ,  $V_b$ ,  $V_c$ ,  $V_d$ ,  $V_{ab}$ ,  $V_{ca}$ ,  $V_{cd}$ ,  $V_{ae}$  and  $V_{ea}$ . [5]**



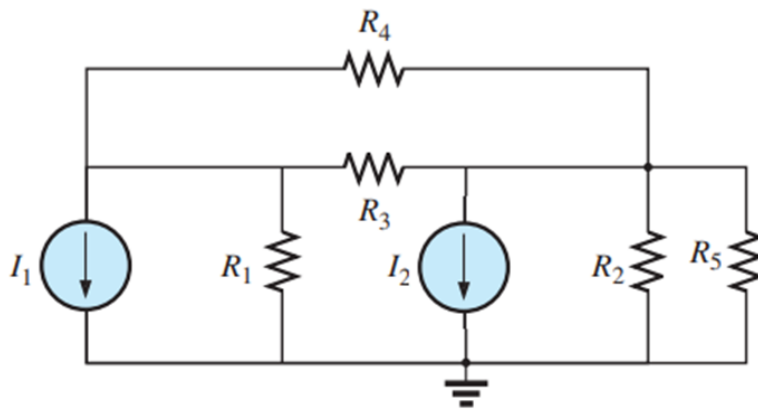
**3. Using Kirchhoff's voltage law, determine the unknown voltages  $V_1$  and  $V_2$  in the following two networks. [5]**



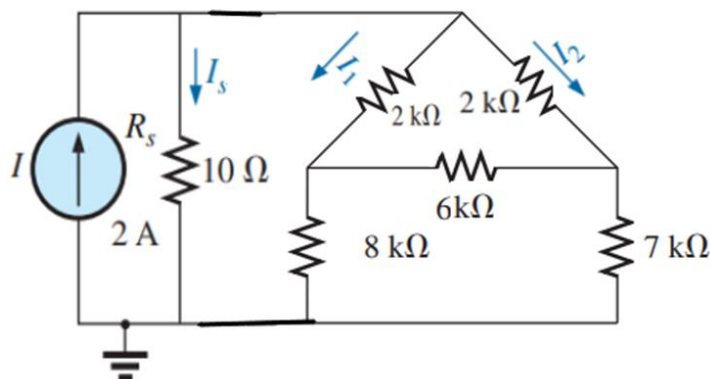
4. Write the clockwise supermesh current equations and simplify them for the following two networks using general approach. (You are not required to solve the equations). Redraw the network with proper current direction and voltage polarities through all the resistor and battery. [5]



5. Assign/label all the nodal voltages. Write the nodal equations for each node using general approach. Redraw the network for each node with proper current direction and voltage polarities through all the resistor and battery. Use  $I_1=2\ \text{A}$  and  $I_2=4\ \text{A}$ .  $R_1=1\ \text{k}\Omega$ ,  $R_2=2\ \text{k}\Omega$ ,  $R_3=3\ \text{k}\Omega$ ,  $R_4=4\ \text{k}\Omega$ ,  $R_5=5\ \text{k}\Omega$ . Solve the equations and find the value of voltage across  $R_3$  resistor. [5]

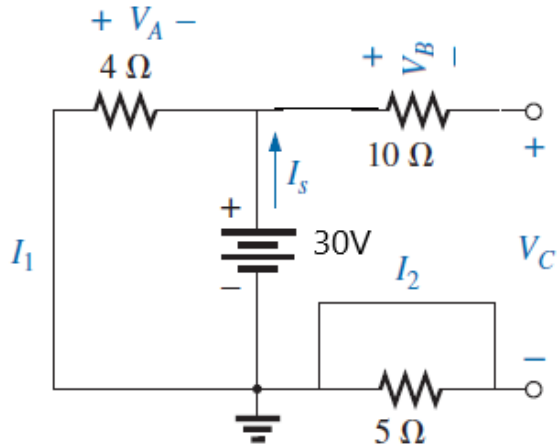


6. Find the current  $I_1$  and  $I_2$  using current divider rules. [5]

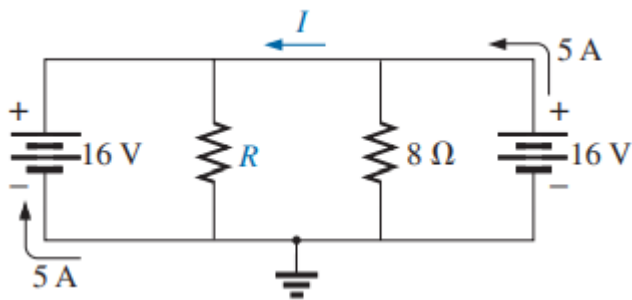


**Bonus Questions: These are optional questions. You can answer any number of questions and get bonus marks.**

7. Determine  $I_s$ ,  $I_1$ ,  $I_2$  and  $V_A$ ,  $V_B$ ,  $V_C$ . Explain the answers in your own words. [2]



8. Assuming identical supplies, determine the current  $I$  and resistance  $R$ . [2]



9. Given the information provided in the Figure find the unknown quantities:  $E$ ,  $R_1$ , and  $I_3$ . [2]

