**EEE 31 Problem Set 1**

**Problem 1**

Given the circuit in Fgure 1.

    a. Find the equivalent resistance, $R_{eq}$, seen terminals A and B.

    b. If a 5V supply is connected at terminals A and B ($V_{AB} = 5V$), find $V_{CD}$ and $V_{EF}$.
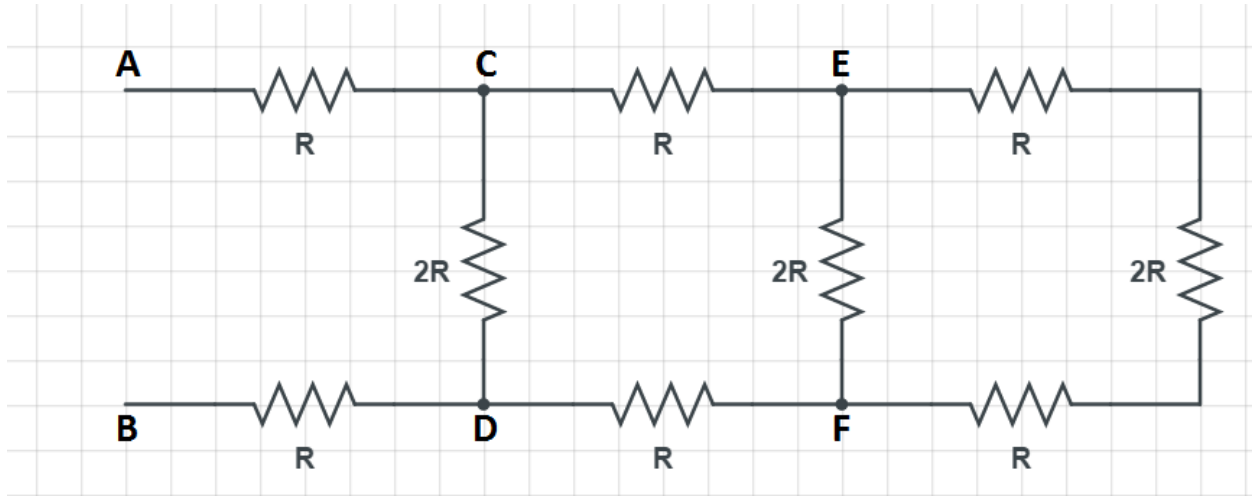


Fig.1

**Problem 2**

Given the circuit in Figure 2.

    a. Express $V_4$ in terms of Vs and the resistors.

    b. If $i_2 = 1A$, and $R_1 = R_2 = R_3 = R_4 = R_5 = 10\ \Omega$, find the value of $V_4$ and Vs.
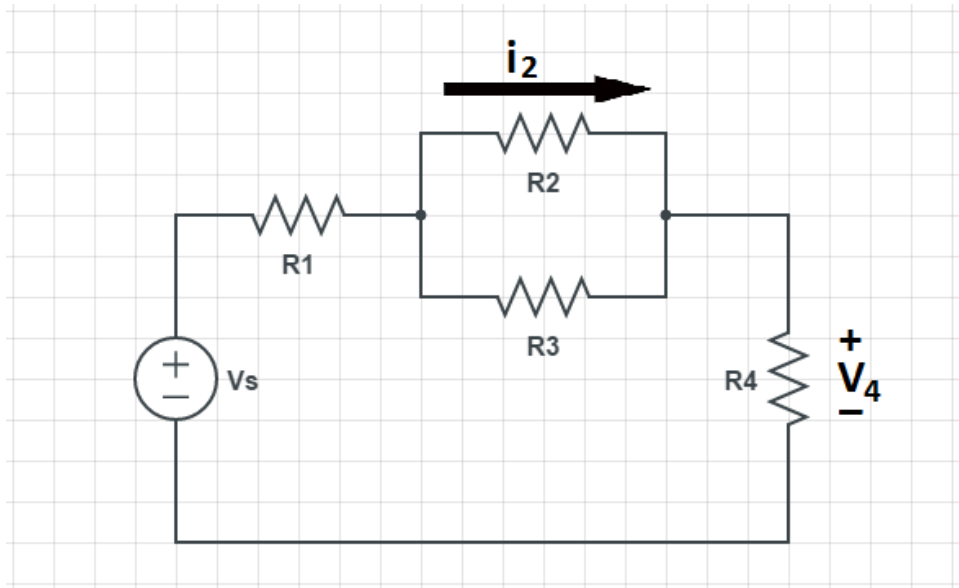


Fig. 2

## Problem 3

A certain device has a V-I characteristics (Y-axis: Voltage, X-axis: Current) shown in Figure 3a. If a voltage shown in Figure 3b is applied to the device,

    a. Plot the current vs time of the device for $0 \leq t \leq 5\,s$
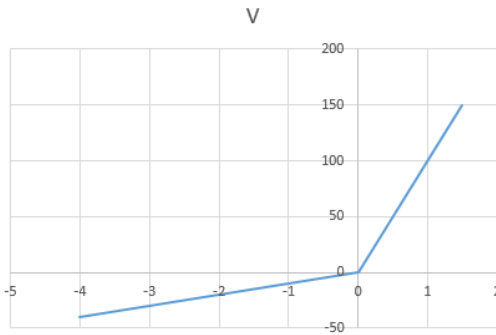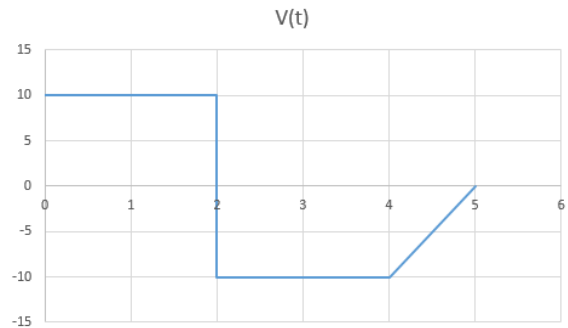    b. Calculate the total energy absorbed by the device from 0 to 5s.



Fig. 3a



Fig. 3b

## Problem 4

Given the circuit in Figure 4

    a. Find all the mesh currents $i_A$, $i_B$, and $i_C$
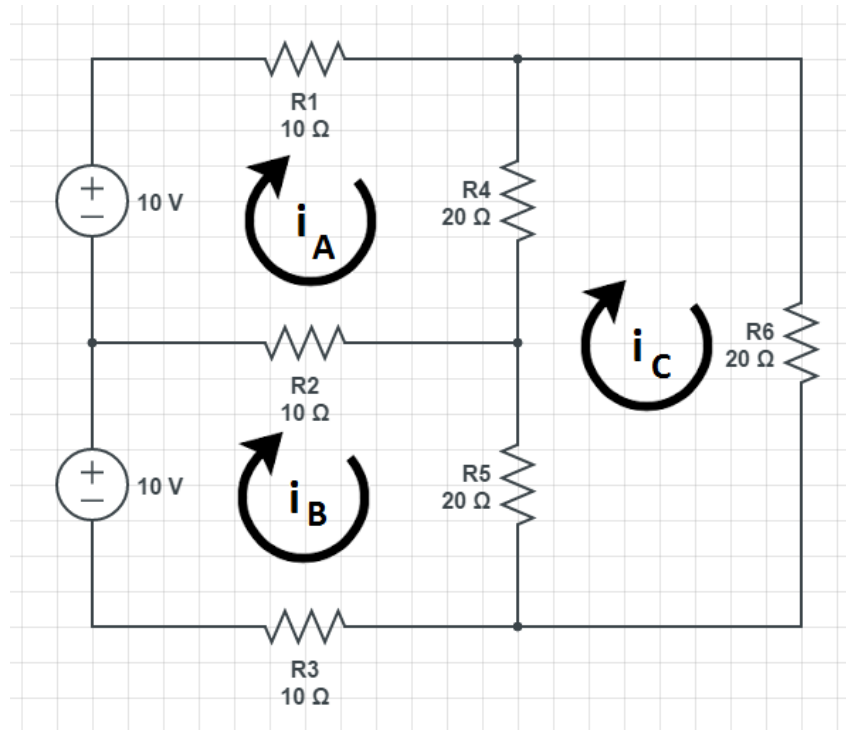    b. Compute the power absorbed by all resistors.



Fig. 4

**Problem 5**

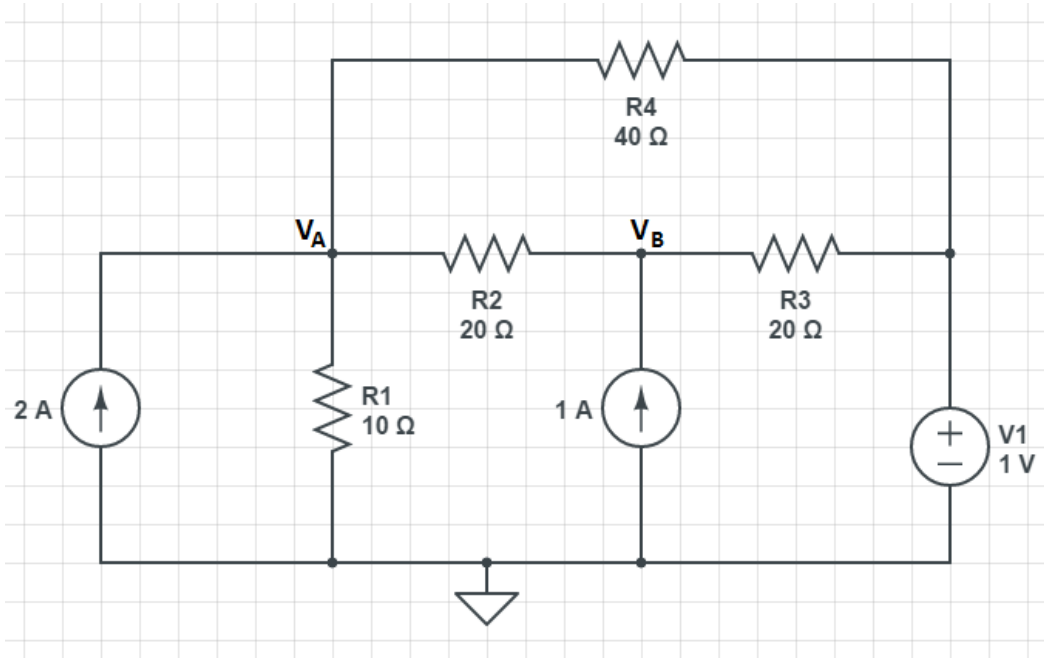Given the circuit in Figure 5, use node voltage analysis to get the voltages across all resistors.



Fig. 5

**Problem 6**

Given the resistance network in Figure 6

    a.  Find the equivalent resistance across A and B in terms of R.
    b.  What value of R will result with an equivalent resistance of 10kΩ
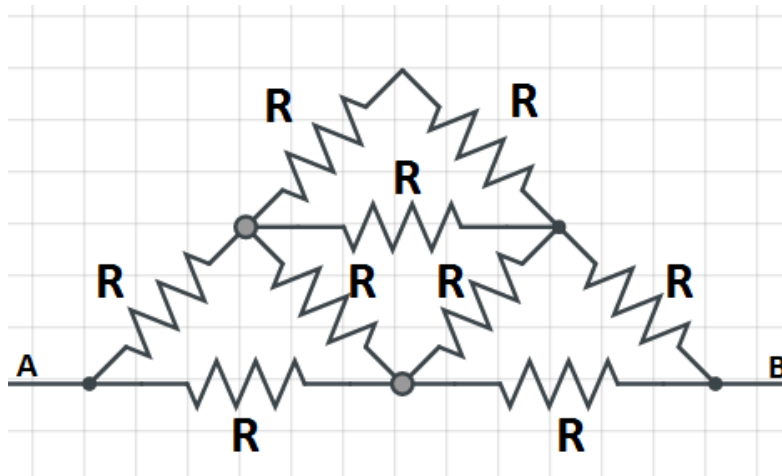


Fig. 6

**Problem 7**

Figure 7 shows a cube resistor. Assume that all resistors have a resistance of R.

   a. If a voltage $V_S$ is applied across A and G ($V_s = V_{AG}$), what is the voltage $V_B$, $V_C$, $V_D$, $V_E$ and $V_F$? Use G as the reference node ($V_G = 0$). Express your answers in terms of R and $V_S$. (Hint: Use the cube's symmetry.)

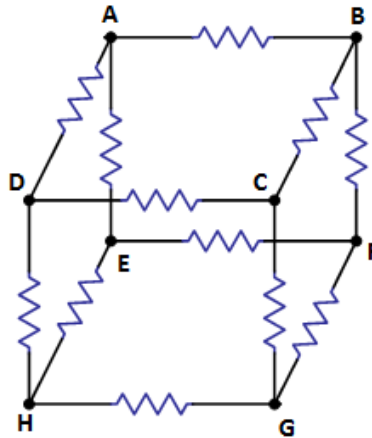   b. Find the value of R such that the equivalent resistance is 10kΩ.



Fig. 7

**Problem 8**

Use mesh analysis to solve the circuit in Figure 8.

   a. Write down the mesh current equations for loops 3 and 4.
   b. Express $i_1$ in terms of $i_2$.
   c. Find the value of all mesh currents.
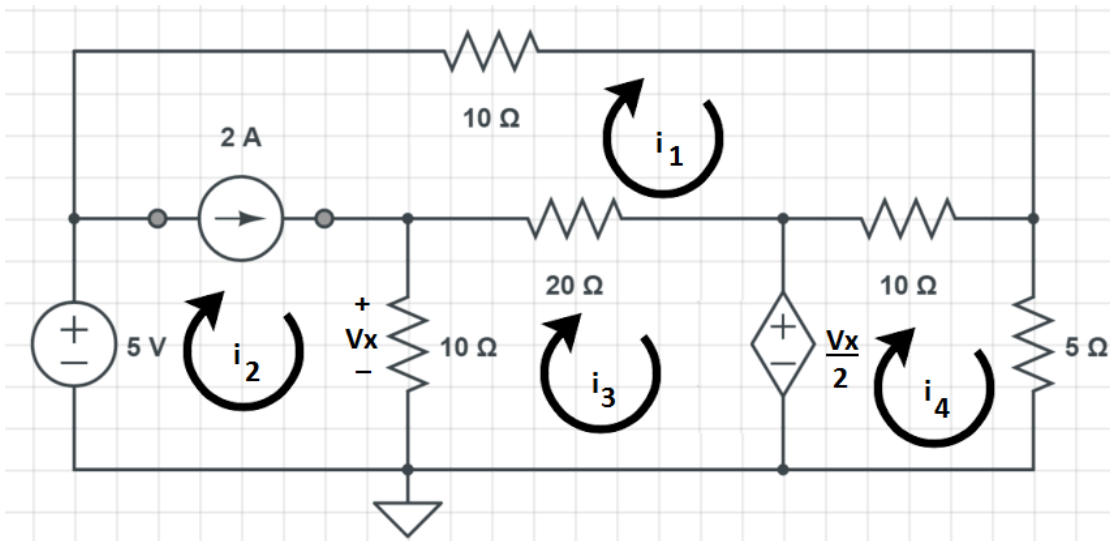   d. Find the value of Vx.



Fig. 8