and any voltage whose positive terminal is reached first as positive.

d. always consider all resistor voltage drops as positive and all voltage sources as negative.

8. The algebraic sum of +40 V and −30 V is

a. −10 V.

b. +10 V.

c. +70 V.

d. −70 V.

9. A principal node is

a. a closed path or loop where the algebraic sum of the voltages must equal zero.

b. the simplest possible closed path around a circuit.

c. a junction where branch currents can combine or divide.

d. none of the above.

10. How many equations are necessary to solve a circuit with two principal nodes?

a. 3.

b. 2.

c. 4.

d. 1.

11. The difference between a mesh current and a branch current is

a. a mesh current is an assumed current and a branch current is an actual current.

b. the direction of the currents themselves.

c. a mesh current does not divide at a branch point.

d. both a and c.

12. Using the method of mesh currents, any resistance common to two meshes has

a. two opposing mesh currents.

b. one common mesh current.

c. zero current.

d. none of the above.

13. The fact that the sum of the resistor voltage drops equals the applied voltage in a series circuit is the basis for

a. Kirchhoff's current law.

b. node-voltage analysis.

c. Kirchhoff's voltage law.

d. the method of mesh currents.

14. The fact that the sum of the individual branch currents equals the total current in a parallel circuit is the basis for

a. Kirchhoff's current law.

b. node-voltage analysis.

c. Kirchhoff's voltage law.

d. the method of mesh currents.

15. If you do not go completely around the loop when applying Kirchhoff's voltage law, then

a. the algebraic sum of the voltages will always be positive.

b. the algebraic sum is the voltage between the start and finish points.

c. the algebraic sum of the voltages will always be negative.

d. the algebraic sum of the voltages cannot be determined.

Essay Questions

1. State Kirchhoff's current law in two ways.
2. State Kirchhoff's voltage law in two ways.
3. What is the difference between a loop and a mesh?
4. What is the difference between a branch current and a mesh current?
5. Define *principal node.*
6. Define *node voltage.*
7. Use the values in Fig. 9–6 to show that the algebraic sum is zero for all voltages around the outside loop ACEFDBA.
8. Use the values in Fig. 9–6 to show that the algebraic sum is zero for all the currents into and out of node C and node D.

Problems

SECTION 9–1 KIRCHHOFF'S CURRENT LAW (KCL)

9–1 If a 5-A I_1 and a 10-A I_2 flow into point X, how much is the current, I_3, directed away from that point?

9–2 Applying Kirchhoff's current law, write an equation for the currents directed into and out of point X in Prob. 9–1.

9–3 In Fig. 9–10, solve for the unknown current, I_3.

9–4 In Fig. 9–11, solve for the following unknown currents: I_3, I_5, and I_8.

9–5 Apply Kirchhoff's current law in Fig. 9–11 by writing an equation for the currents directed into and out of the following points:

a. Point X

b. Point Y

c. Point Z

Figure 9–10