SAFETY

1. Think
2. To prevent a current path from being established through the heart
3. 0.100–0.200 A
4. The heart vibrates at a high rate and does not pump blood to the rest of the body.
5. It causes the heart to contract and then relax.

EXERCISE 1

THE POWER SUPPLY

11.

Terminals	Voltage (volts)	AC/DC	Fix/Var (F) (V)	Current (amps)
1-2	208	AC	F	15
1-3	208	AC	F	15
2-3	208	AC	F	15
1-N	120	AC	F	15
2-N	120	AC	F	15
3-N	120	AC	F	15
4-5	208	AC	V	5
4-6	208	AC	V	5
5-6	208	AC	V	5
4-N	120	AC	V	5
5-N	120	AC	V	5
6-N	120	AC	V	5
7-N	120	DC	V	8
8-N	120	DC	F	2

13. No
14. 208 VAC
17. Upscale
19.

Terminals	Voltage (volts)	Fix/Var (F) (V)
1-2	208	F
1-3	208	F
2-3	208	F
1-N	120	F
2-N	120	F
3-N	120	F
4-5	208	V
4-6	208	V
5-6	208	V
4-N	120	V
5-N	120	V
6-N	120	V

23. 140 VDC
25. Yes
27. Yes
28. Polarity-sensitive
31. 145 VDC
33. Fixed
36. 0.4 A
37. 0.4 A

Review Questions

1. 15 A
2. 208 VAC
3. Variable
4. Fixed
5. 120 VAC
6. 2 ADC
7. DC
8. 5 AAC
9. Yes
10. Yes

EXERCISE 2

OHM'S LAW

3. 1.2 A
4. 144 W
6. 1.2 A
9. 2 A
10. 240 W
12. 2 A

Review Questions

1. 7.5 A
2. 900 W
3. 0.833 A
4. 144 Ω
5. 10 A

EXERCISE 3

SERIES CIRCUITS

3. 740 Ω
4. 740 Ω

6. 0.281 A
7. E_1 = 84.3 V E_2 = 56.2 V E_3 = 67.4 V
9. 0.28 A
10. 84 V
13. 56 V
15. 67 V

Review Questions

1. A circuit that has only one path for current flow
2. A. The current is the same at all points in the circuit.
B. The total resistance is the sum of the resistances of the individual resistors.
C. The applied voltage is equal to the sum of the voltage drops across the individual resistors.
3. 462 Ω
4. 0.0519 A
5. 160 Ω = 8.3 V
100 Ω = 5.19 V
82 Ω = 4.25 V
120 Ω = 6.23 V

EXERCISE 4

PARALLEL CIRCUITS

3. 100 Ω
5. 100 Ω
8. I_1 = 0.5 A I_2 = 0.3 A I_3 = 0.4 A
9. I_T = 1.2 A
10. 144 W
12. I_T = 0.5 A I_2 = 0.3 A I_3 = 0.4 A
14. 140 W (Wattmeters typically read low downrange)
18. 200 Ω
20. 200 Ω
23. I_T = 0.2 A I_2 = 0.1 A I_3 = 0.3 A
24. I_T = 0.6 A
25. 72 W
27. I_T = 0.2 A I_2 = 0.1 A I_3 = 0.3 A
29. 68 W

Review Questions

1. R_T = 572.043 Ω
2. I_T = 9.76 A
3. W_T = 400 W I_T = 3.33 A
4. Decrease I_T = 12 A
5. R_3 = 120 Ω

EXERCISE 5

COMBINATION CIRCUITS

8. 440 Ω
12. A_1 = 0.45 A A_2 = 0.27 A A_3 = 0.18 A
14. V_2 = 91 V V_3 = 109 V
18. R_C = 200 Ω
19. R_T = 500 Ω
20. R_T = 500 Ω
24. I_T = 0.4 A
25. E_1 = 120 V E_C = 80 V
26. I_2 = 0.267 A I_3 = 0.133 A
28. A_1 = 0.4 A A_2 = 0.26 A A_3 = 0.13 A
30. V_2 = 120 V V_3 = 80 V
40. R_T = 222 Ω
44. A_1 = 0.5 A A_2 = 0.3 A A_3 = 0.22 A
(NOTE: It may be necessary to change the range of meter A_1.)
46. V_1 = 120 A V_2 = 48 A V_3 = 72 A
50. R_C = 600 Ω
51. R_T = 200 Ω
52. I_T = 0.6 A
53. I_T = 0.4 A I_C = 0.2 A
54. E_2 = 40 V E_3 = 80 V
56. R_T = 200 Ω
60. A_1 = 0.6 A A_2 = 0.4 A A_3 = 0.2 A
62. V_1 = 120 V V_2 = 40 V V_3 = 80 V

Review Questions

1. A. The sum of the voltage drops across the individual resistors is equal to the applied voltage (voltage drops add).
B. The current is the same at all points in a series circuit (current remains the same).

C. Total resistance is equal to the sum of the resistances of the individual resistors (resistance adds).

2. A. The voltage is the same across all components in a parallel circuit (voltage remains the same).

B. The total current is equal to the sum of the currents flowing through all the individual paths (current adds).

C. The reciprocal of the total resistance is equal to the sum of the reciprocals of the individual resistors.

3. $R_T = 2533.3\ \Omega$

4. $I_T = 9.47$ mA

5. $E_1 = 11.37$ V $E_2 = 12.63$ V
$E_3 = 12.63$ V
$I_1 = 9.47$ mA $I_2 = 5.26$ mA
$I_3 = 4.21$ mA

6. $R_T = 275.67\ \Omega$

7. $I_T = 0.218$ A

8. $E_1 = 60$ V $E_2 = 27$ V $E_3 = 33$ V
$I_1 = 0.118$ A $I_2 = 0.1$ A $I_3 = 0.1$ A

EXERCISE 6

ALTERNATING CURRENT RESISTIVE CIRCUITS

4. 120 V 2 A 240 W

5. 240 VA

Review Questions

1. They are in phase with each other.

2. 1500 W

3. 1920 W

4. 264 W

5. 1800 W

EXERCISE 7

INDUCTANCE IN ALTERNATING CURRENT CIRCUITS

1.

Total L (henrys)	Total X_L (ohms)	Inductance of inductors in parallel (henrys)								
3.2	1206	3.2								
1.6	603.2		1.6							
.8	391.6			.8						
1.07	403.4	3.2	1.6							
.64	241.3	3.2		.8						
.533	200.9	3.2	1.6	.8						
.457	172.3	3.2	1.6	.8						
.4	150.8	3.2	1.6	.8	3.2					
.32	120.5	3.2	1.6	.8	3.2	1.6				
.228	85.9	3.2	1.6	.8	3.2	1.6	.8			
.213	80.3	3.2	1.6	.8	3.2	1.6	.8	3.2		
.188	70.9	3.2	1.6	.8	3.2	1.6	.8	3.2	1.6	.8
.152	57.3	3.2	1.6	.8	3.2	1.6	.8	3.2	1.6	.8

3.

Total L (henrys)	Total X_L (ohms)	Inductance of inductors in parallel (henrys)								
3.2	1200	3.2								
1.6	600		1.6							
.8	300			.8						
1.07	400	3.2	1.6							
.64	240	3.2		.8						
.533	200		1.6	.8						
.475	180	3.2	1.6	.8						
.4	150	3.2	1.6	.8	3.2					
.32	120	3.2	1.6	.8	3.2	1.6				
.228	86	3.2	1.6	.8	3.2	1.6	.8			
.213	80	3.2	1.6	.8	3.2	1.6	.8	3.2		
.188	71	3.2	1.6	.8	3.2	1.6	.8	3.2	1.6	
.152	57	3.2	1.6	.8	3.2	1.6	.8	3.2	1.6	.8

8. 1.97 H

9. 742.7 Ω

10. 0.16 A

11. 0.16 A

12. 750 Ω

13. 1.99 H