https://ebookyab.ir/solution-manual-circuit-analysis-robbins-miller/
Email: ebookyab.ir@gmail.com, Phone:+989359542944 (Telegram, WhatsApp, Eitaa)

This solution manual has solutions for Odd and Even problems

Chapter

1

Introduction

1.3 Converting Units

1. a. $27\ \text{min} \times (60\ \text{s/min}) = 1620\ \text{s}$

b. $0.8\ \text{h} \times (3600\ \text{s/h}) = 2880\ \text{s}$

c. $\left(2\text{h} \times \dfrac{3600\ \text{s}}{\text{h}}\right) + \left(3\ \text{min} \times \dfrac{60\ \text{s}}{\text{min}}\right) + 47\ \text{s} = 7427\ \text{s}$

d. $35\ \text{hp} \times (746\ \text{W/hp}) = 26\ 110\ \text{W}$

e. $1827\ \text{W} \times \dfrac{1\ \text{hp}}{746\ \text{W}} = 2.45\ \text{hp}$

f. $23\ \text{rev.} \times 360^\circ/\text{rev} = 8280^\circ$

3. a. $1.2\ \text{m} \times 70\ \text{cm} \times \dfrac{1\ \text{m}}{100\ \text{cm}} = 0.84\ \text{m}^2$

b. $\dfrac{1}{2}\left(25\ \text{cm} \times \dfrac{1\ \text{m}}{100\ \text{cm}}\right)(0.5\ \text{m}) = 0.0625\ \text{m}^2$

c. $\left(10\ \text{cm} \times \dfrac{1\ \text{m}}{100\ \text{cm}}\right)\left(25\ \text{cm} \times \dfrac{1\ \text{m}}{100\ \text{cm}}\right)\left(80\ \text{cm} \times \dfrac{1\ \text{m}}{100\ \text{cm}}\right) = 0.02\ \text{m}^3$

d. $\dfrac{4\pi}{3}\left(10\ \text{in} \times \dfrac{2.54\ \text{cm}}{\text{in}} \times \dfrac{1\ \text{m}}{100\ \text{cm}}\right)^3 = 0.0686\ \text{m}^3$

5. $\dfrac{15\ \text{parts}}{12\ \text{s}} \times \dfrac{3600\ \text{s}}{\text{h}} = 4500\ \text{parts/h}$

7. $\dfrac{27\ \text{mi}}{\text{gal}} \times \dfrac{1.609\ \text{km}}{\text{mi}} \times \dfrac{1\ \text{gal}}{3.785\ \text{liters}} = 11.5\ \text{km/liter}$

9. $\dfrac{18^\circ}{0.02\ \text{s}} \times \dfrac{1\ \text{rev}}{360^\circ} \times \dfrac{60\ \text{s}}{1\ \text{min}} = 150\ \text{rpm}$

11. $\dfrac{60\ \text{mi}}{\text{h}} \times 500\ \text{s} \times \dfrac{1\ \text{h}}{3600\ \text{s}} = 8.33\ \text{mi}$

13. $\dfrac{2000\ \text{yd}}{\text{h}} \times \dfrac{0.914\ \text{m}}{\text{yd}} \times \dfrac{1\ \text{h}}{3600\ \text{s}} = 0.508\ \text{m/s}$

15. $\dfrac{3\ \text{km}}{\text{h}} \times \dfrac{8}{60}\ \text{h} + \dfrac{5\ \text{km}}{\text{h}} \times 1.25\ \text{h} + \dfrac{4\ \text{km}}{\text{h}} \times \dfrac{12}{60}\ \text{h} = 7.45\ \text{km}$

17. $\dfrac{2\ \text{km}}{\text{h}} \times \dfrac{15}{60}\ \text{h} + \dfrac{5\ \text{km}}{\text{h}} + \dfrac{18\ \text{h}}{60}\ \text{h} + \dfrac{2.5\ \text{km}}{\text{h}} \times t_3 = 2.85\text{km}$

Thus, $t_3 = 0.34\text{h} = 20.4$ minutes.

19. Machine 1: $\dfrac{\$0.43}{\text{min}} \times \dfrac{60\ \text{min}}{\text{h}} = \$25.80/\text{h}$

Machine 2: $\dfrac{\$200}{8\ \text{h}} = \$25.00/\text{h}$ (This one is cheaper to operate. Buy it.)

1.4 Power of Ten Notation

21. a. 8.675×10^3

b. 8.72×10^{-3}

c. 1.24×10^3

d. 3.72×10^{-1}

e. 3.48×10^2

f. 2.15×10^{-7}

g. 1.47×10^1

23. a. $\dfrac{1.25 \times 10^2}{1 \times 10^3} = 1.25 \times 10^{-1}$

b. $\dfrac{8 \times 10^4}{1 \times 10^{-3}} = 8 \times 10^7$

c. $\dfrac{3 \times 10^4}{1.5 \times 10^6} = 2 \times 10^4 \times 10^{-6} = 2 \times 10^{-2}$

d. $\dfrac{(16)(21.8) \times 10^{-7} \times 10^6}{(14.2)(12) \times 10^{-5}} = 2.05 \times 10^4$

25. a. $(4 \times 10^3)(5 \times 10^{-2})^2 = (4 \times 10^3)(25 \times 10^{-4})$
$= 100 \times 10^{-1} = 10$

b. $(4 \times 10^3)(-5 \times 10^{-2})^2 = (4 \times 10^3)(25 \times 10^{-4}) = 10$

c. $\dfrac{(6 \times 10)^2}{(10 \times 10^{-1})} = \dfrac{36 \times 10^2}{1} = 3.6 \times 10^3$

d. $\dfrac{(50)^{-2}(2.5 \times 10^6)(6 \times 10^3)}{(1 \times 10^3)(2 \times 10^{-1})^2} = \dfrac{(2.5)(6) \times 10^6 \times 10^3}{(5 \times 10)^2(1 \times 10^3)(4 \times 10^{-2})}$

$= \dfrac{15 \times 10^9}{25 \times 10^2 \times 10^3 \times 4 \times 10^{-2}} = \dfrac{15 \times 10^9}{100 \times 10^3}$

$= 0.15 \times 10^6 = 15 \times 10^4$

e. $\dfrac{(-0.027)^{1/3}(-0.2)^2}{(24)^\circ \times 10^{-3}} = \dfrac{(-0.3)(-2 \times 10^{-1})^2}{1 \times 10^{-3}}$

$= \dfrac{(-0.3)(4 \times 10^{-2})}{1 \times 10^{-3}} = -12$

27. i. $(8.42 \times 10^2)(1.4 \times 10^{-3}) = 11.79 \times 10^{-1} = 1.179$

ii. $\dfrac{3.52 \times 10^{-2}}{7.91 \times 10^{-3}} = 0.445 \times 10^1 = 4.45$

Direct computation for these examples is less work.

29. 6.24×10^{18}

31. $\dfrac{6.24 \times 10^{18} \text{ electrons}}{1 \text{ s}} \times 10.03 \times 10^3 \text{ s}$

$= 62.6 \times 10^{21}$ electrons

33. $t = \dfrac{3.47 \times 10^5 \text{ km}}{299\,792.458 \text{ km/s}} = 1.16 \text{ s}$

35. $\dfrac{3.73 \times 10^4 \text{ m}^3}{1 \text{ s}} \times \dfrac{3600 \text{ s}}{1 \text{ h}} \times \dfrac{1 \text{ liter}}{1 \times 10^{-3} \text{ m}^3}$

$= 13.4 \times 10^{10}$ liters/h

1.5 Prefixes

37. a. kilo, k
b. mega, M
c. giga, G
d. micro, μ
e. milli, m
f. pico, p

39. a. 1.5 ms
b. 27 μs
c. 350 ns

41. a. 150×10^3 V; 0.15×10^6 V
b. 0.33×10^{-3} W; 33×10^{-5} W

43. a. 330 V + 150 V + 200 V = 680 V
b. 60 W + 100 W + 2.7 W = 162.7 W

45. 1500 W = 1.5×10^3 W = 1.5 kW

47. $I_3 = I_1 + I_2 + I_4 = 12 \text{ A} + 150 \text{ A} + 25 \text{ A} = 187 \text{ A}$

49. 39 mmfd = 39$\mu\mu$F = $39 \times 10^{-6} \times 10^{-6} = 39 \times 10^{-12}$F
= 39 pF

51. Radio signal: $t = \dfrac{5000 \text{ km}}{299\,792.458 \text{ km/s}} = 16.68 \text{ ms}$

Telephone signal: $t = \dfrac{5000 \times 10^3 \text{ m}}{150 \text{ m/}\mu\text{s}} = 33.33 \text{ ms}$

$\therefore$ Radio signal arrives first by 16.65 ms.

53. a. $R = \dfrac{V}{I} = \dfrac{50 \text{ V}}{24 \text{ mA}} = 2.083 \text{ k}\Omega$. (Since V and I are specified as exact, you can use as many digits as you like.)

b. $R_{\max} = \dfrac{V_{\max}}{I_{\min}} = \dfrac{50.1 \text{ V}}{23.9 \text{ mA}} = 2.096 \text{ k}\Omega = 2.10 \text{ k}\Omega$

when rounded to 3 digits

$R_{\min} = \dfrac{V_{\min}}{I_{\max}} = \dfrac{49.9 \text{ V}}{24.1 \text{ mA}} = 2.071 \text{ k}\Omega = 2.07 \text{ k}\Omega$

when rounded to 3 digits.

The actual value of R lies somewhere between 2.07 kΩ and 2.10 kΩ.

55. See CD in the back of the book.

1.6 Circuit Diagrams

57. Same as Figure 1–7(a) of the text.

https://ebookyab.ir/solution-manual-circuit-analysis-robbins-miller/
Email: ebookyab.ir@gmail.com, Phone:+989359542944 (Telegram, WhatsApp, Eitaa)

Chapter

2

Voltage and Current

2.1 Atomic Theory

1. There are of the order of 10^{23} free electrons per cm^3 at room temperature in copper.

   a. $1\ m^3 = (100\ cm)^3 = 10^6\ cm^3$. Thus, the number of electrons is

   $$N = \frac{10^{23}\ \text{electrons}}{\cancel{cm}^3} \times 10^6\ \cancel{cm}^3 = 10^{29}\ \text{electrons}$$

   b. Volume =

   $$\frac{\pi d^2}{4} \times l = \frac{\pi}{4}(0.163\ cm)^2(500\ cm) = 10.4\ cm^3$$

   $$N = \frac{10^{23}\ \text{electrons}}{\cancel{cm}^3} \times 10.4\ \cancel{cm}^3$$

   $$= 10.4 \times 10^{23}\ \text{electrons}$$

3. Original: $F_1 = k\dfrac{Q_1 Q_2}{r_1^2}$

   New: $F_2 = \dfrac{k(2Q_1)(3Q_2)}{\left(\frac{r_1}{2}\right)^2} = \dfrac{(2)(3)}{\left(\frac{1}{2}\right)^2}\left[k\dfrac{Q_1 Q_2}{r_1^2}\right] = 24\ F_1$

   $\therefore$ Force increases by a factor of 24.

5. a. It has a lot of free electrons. This results from having few (e.g., 1) electrons in its valence shell

   b. Inexpensive and easily formed into wires.

   c. Has a full valence shell. Therefore, no free electrons.

   d. The electrical force is so great that electrons are torn from their parent atoms. This movement of electrons constitutes a current. We see the effect as a lightning discharge.

2.2 The Unit of Electrical Charge: The Coulomb

7. a. $$F = \frac{9 \times 10^9 (1 \times 10^{-6}\ C)(7 \times 10^{-6}\ C)}{(10 \times 10^{-3})^2}$$

   $= 630\ N$ (repulsive)

   b. $$F = \frac{9 \times 10^9 (8 \times 10^{-6})(4 \times 10^{-6})}{(0.12)^2}$$

   $= 20\ N$ (attractive)

   c. $$F = \frac{9 \times 10^9 (1.602 \times 10^{-19})^2}{(12 \times 10^{-8})^2}$$

   $= 1.60 \times 10^{-14}\ N$ (replusive)

   d. $$F = \frac{9 \times 10^9 (1.602 \times 10^{-19})^2}{(5.3 \times 10^{-11})^2}$$

   $= 8.22 \times 10^{-8}\ N$ (attractive)

   e. Neutron is uncharged $\therefore F = 0$

9. $$180\ N = \frac{9 \times 10^9 (4 \times 10^{-6}) Q_2}{(2 \times 10^{-2})^2} \quad \therefore Q_2 = 2\mu C \text{ (Attractive)}$$

11. $$0.02\ N = \frac{9 \times 10^9 Q_1 (5\ Q_1)}{(0.5)^2}$$

    $$0.02 = 180 \times 10^9\ Q_1^2$$

    $\therefore Q_1 = 0.333\ \mu C$ and $Q_2 = 1.67\ \mu C$, both (+) or both (–).

13. $19 \times 10^{13}\ \cancel{\text{electron}} \times 1.6 \times 10^{-19}$ coulomb/$\cancel{\text{electron}}$
    $= 30.4\ \mu C$

15. $Q_1 = -(14.6 \times 10^{13} \times 1.60 \times 10^{-19}) = -23.4\ \mu C$

    $Q_2 = 1.3\ \mu C$

    $Q_{final} = Q_{initial} + Q_1 + Q_2$

    $5.6\ \mu C = Q_{initial} - 23.4\ \mu C + 1.3\ \mu C$

    $\therefore Q_{initial} = 27.7\ \mu C$ (positive)

2.3 Voltage

17. $$V = \frac{W}{Q} = \frac{360\ J}{15\ C} = 24\ V$$

19. $$V = \frac{W}{Q} = \frac{1200\ J}{0.5\ C} = 2400\ V$$

21. $$W = QV = (0.5 \times 10^{-6}\ C)(8.5 \times 10^3\ V) = 4.25\ mJ$$

23. $$Q = \frac{W}{V} = \frac{57\ J}{12\ V} = 4.75\ C$$

https://ebookyab.ir/solution-manual-circuit-analysis-robbins-miller/
Email: ebookyab.ir@gmail.com, Phone:+989359542944 (Telegram, WhatsApp, Eitaa)

2.4 Current

25. $I = \frac{Q}{t} = \frac{250\ \mu\text{C}}{5\ \text{ms}} = 50\ \text{mA}$

27. $Q = It = (16.7\ \text{mA})(20\ \text{ms}) = 334\ \mu\text{C}$

29. $Q = (93.6 \times 10^{12})(1.6 \times 10^{-19}) = 15\ \mu\text{C}$

$$I = \frac{Q}{t} = \frac{15 \times 10^{-6}\ \text{C}}{5 \times 10^{-3}\ \text{s}} = 3\ \text{mA}$$

31. At $t = 0$, $q_0 = 20$ C. At $t = 1$ s, $q_1 = 100$ C.

$$I = \frac{\Delta q}{\Delta t} = \frac{100\ \text{C} - 20\ \text{C}}{1\ \text{s}} = \frac{80\ \text{C}}{1\ \text{s}} = 80\ \text{C/s} = 80\ \text{A}$$

33. $$Q = \frac{47 \times 10^{19}\ \text{electrons}}{6.24 \times 10^{18}\ \text{electrons/C}} = 75.3\ \text{C}$$

$$V = \frac{W}{Q} = \frac{1353.6\ \text{J}}{75.3} = 18.0\ \text{V}$$

$$I = \frac{Q}{t} = \frac{75.3\ \text{C}}{78\ \text{s}} = 0.966\ \text{A}$$

.

2.5 Practical DC Sources

35. a. $E_T = 1.47 + 1.61 + 1.58 = 4.66$ V

b. $E_T = 1.47 + 1.61 - 1.58 = 1.50$ V

37. $$\text{Life} = \frac{\text{capacity}}{\text{drain}} = \frac{1400\ \text{mAh}}{28\ \text{mA}} = 50\ \text{h}$$

39. From Figure 2-15, capacity at 5˚C is 90% of its value MAX at 25˚C. Therefore, capacity = 0.9 Max = 81 Ah. Thus, Max = 81/0.9 = 90 Ah. At –15˚C, capacity = 0.65 Max = 0.65 (90) = 58.5 Ah. Thus, life ≈ 58.5 Ah/5 A = 11.7 h.

2.6 Measuring Voltage and Current

41. Both

43. The voltmeter and ammeter are interchanged.

45. Meter 1: Reading is 7 A, Meter 2: Reading is –7 A

2.7 Switches, Fuses, and Circuit Breakers

47. When a fuse “blows,” it becomes an open circuit with source voltage across it. The voltage rating tells you how much voltage you can use the fuse with so that it does not arc over when it blows.

CHAPTER

1

Introduction

1.3 Converting Units

2. a. $27\ \cancel{\text{ft}} \times \dfrac{0.3048\ \text{m}}{\cancel{\text{ft}}} = 8.23\ \text{m}$

b. $2.3\ \cancel{\text{yd}} \times \dfrac{0.914\ \cancel{\text{m}}}{\cancel{\text{yd}}} \times \dfrac{100\ \text{cm}}{\cancel{\text{m}}} = 210.2\ \text{cm}$

c. $C = \dfrac{5}{9}(F - 32^\circ) = \dfrac{5}{9}(36^\circ - 32^\circ) = 2.22^\circ\ C$

d. $18\ \cancel{\text{gallons}} \times \dfrac{3.785\ \text{liters}}{\cancel{\text{gallon}}} = 68.1\ \text{liters}$

e. $100\ \cancel{\text{ft}}^2 \times \dfrac{(0.3048)^2\ \text{m}^2}{\cancel{\text{ft}}^2} = 9.29\ \text{m}^2$

f. $124\ \cancel{\text{in}}^2 \times \dfrac{6.452 \times 10^{-4}\text{m}^2}{\cancel{\text{in}}^2} = 0.08\ \text{m}^2$

g. $47\ \cancel{\text{lb}} \times \dfrac{4.448\ \text{N}}{\cancel{\text{lb}}} = 209.1\ \text{N}$

4. $\dfrac{300\ \cancel{\text{rev}}}{\cancel{\text{min}}} \times \dfrac{\dfrac{1}{60}\ \cancel{\text{min}}}{\text{s}} \times \dfrac{360\ \text{deg}}{\cancel{\text{rev}}} = 1800\ \text{deg/s}$

6. $\dfrac{8\ \text{pages}}{\cancel{\text{min}}} \times \dfrac{60\ \cancel{\text{min}}}{\cancel{\text{h}}} \times \dfrac{1}{10}\ \cancel{\text{h}} = 48\ \text{pages}$

8. $\text{Circum} = 2\pi r = 2\pi(3963\ \cancel{\text{mi}}) \times \dfrac{1.609\ \text{km}}{\cancel{\text{mi}}}$
$= 40\,065\ \text{km}$

10. $16\ \cancel{\text{hand}} \times \dfrac{4\ \cancel{\text{in}}}{\cancel{\text{hand}}} \times \dfrac{1\ \text{m}}{39.37\ \cancel{\text{in}}} = 1.63\ \text{m} = 163\ \text{cm}$

12. $d = \dfrac{circumference}{\pi} = \dfrac{47\ \text{in}}{\pi} = 14.96\ \text{in}$

$d = 14.96\ \cancel{\text{in}} \times \dfrac{1\ \text{m}}{39.37\ \cancel{\text{in}}} = 0.380\ \text{m}$

$t = \dfrac{\text{distance}}{\text{velocity}} = \dfrac{0.380\ \cancel{\text{m}}}{0.12\ \cancel{\text{m}}/\text{s}} = 3.17\ \text{s}$

14. $238\,857\ \cancel{\text{mi}} \times \dfrac{1.609\ \cancel{\text{km}}}{\cancel{\text{mi}}} \times \dfrac{1000\ \text{m}}{\cancel{\text{km}}}$
$= 384\,320\,913\ \text{m}$

$t = \dfrac{384\,320\,913\ \cancel{\text{m}}}{299\,792\,458\ \cancel{\text{m}}/\text{s}} = 1.28\ \text{s}$

16. $\dfrac{2\ \text{mi}}{\text{h}} \times \dfrac{12}{60}\ \text{h} + \dfrac{4\text{mi}}{\text{h}} \times 0.75\ \text{h} + \dfrac{5\ \text{mi}}{\text{h}} \times \dfrac{15}{60}\ \text{h} = 4.65\ \text{mi}$

18. $\dfrac{1.5\ \text{mi}}{\text{h}} \times \dfrac{16}{60}\ \text{h} + \dfrac{3.5\ \text{mi}}{\text{h}} \times t_2 + \dfrac{3\ \text{mi}}{\text{h}} \times \dfrac{12}{60}\ \text{h} = 1.7\ \text{mi}$

$t_2 = 0.2\ \text{h} = 12\ \text{min}$

20. $1\ \text{hp} = \dfrac{550\ \cancel{\text{ft-lbs}}}{\text{s}} \times \dfrac{0.3048\ \text{m}}{\cancel{\text{ft}}} \times \dfrac{4.448\ \text{N}}{\cancel{\text{lb}}}$
$= \dfrac{746\ \text{N–m}}{\text{s}} = 746\ \text{J/s} = 746\ \text{W}$

1.4 Power of Ten Notation

22. a. 1.76×10^3

b. 3.78×10^1

c. 2.1×10^2

d. 1.065×10^{-10}

e. 1.25×10^2

f. 2.76×10^{-5}

24. a. $123.7 + 0.05 + 1.259 = 125.0$

b. $0.723 + 0.001 = 0.724$

c. $8695 - 383 = 8312$

d. $4.52 + 6.97 = 11.49$

26. a. $(0.452 \times 10^3)(6.73 \times 10^4) = 3.042 \times 10^7$

b. $(0.985 \times 10^{-2})(4.7 \times 10^3) = 4.630 \times 10^1$

c. $\dfrac{8.92 \times 10^{-2}}{6.73 \times 10^{-5}} = 1.325 \times 10^3$

d. $1.240 \times 10^1 - 0.236 \times 10^1 = 1.004 \times 10^1$

e. $(1.27)^3 + \dfrac{47.9}{(0.8)^2} = 7.689 \times 10^1$

f. $(-6.43 \times 10^{-1})^3 = -2.658 \times 10^{-1}$

g. $(0.05)(1.6 \times 10^4) = 8.000 \times 10^2$

h. $\dfrac{-0.3}{1.5 \times 10^{-4}} = -2.000 \times 10^3$

i. $\dfrac{(4.5 \times 10^{-3})^2 \times (729)^{1/3}}{(3.5 \times 10^4)^2\{[(8.72 \times 10^{-3})(47)^3] - 356\}}$
$= 2.708 \times 10^{-16}$

28. a. 349 000

b. 15.1

c. 0.02346

d. 0.0697

e. 4578.697

f. 0.0000697

30. $8.999 \times 10^{-31}\ \text{kg}$

32. $(299\,792.458 \times 10^3 \text{ m/s})(1.2 \times 10^{-8} \text{ s}) = 3.598\text{m}$

34. $$365 \text{ days} \times \frac{24 \text{ h}}{\text{day}} \times \frac{3600 \text{ s}}{\text{h}} \times \frac{299\,792.458 \text{ km}}{\text{s}}$$
$$= 9.45 \times 10^{12} \text{ km}$$

36. $$m_1 = \frac{4\,\pi\, r^3}{3} \times \text{density} = \frac{4\pi}{3}\left(5000 \text{ mi} \times \frac{1609\text{m}}{\text{mi}}\right)^3 \times \frac{25 \text{ kg}}{\text{m}^3}$$
$$m_1 = 5.453 \times 10^{22} \text{ kg}$$
$$m_2 = \frac{4\pi}{3}\left(10000 \times 10^3\text{m}\right)^3 \times \frac{12 \text{ kg}}{\text{m}^3} = 5.0265 \times 10^{22} \text{ kg}$$
$$F = 6.6726 \times 10^{-11} \frac{(5.453 \times 10^{22})(5.0265 \times 10^{22})}{\left(100000 \text{ mi} \times \frac{1609\text{m}}{\text{mi}}\right)^2} \text{ N} = 70.6 \times 10^{17} \text{ N}$$

1.5 Prefixes

38. a. mA
    b. kV
    c. MW
    d. μs
    e. μm
    f. ms
    g. nA

40. a. 0.156 V
    b. 150 μV
    c. 47 000 W
    d. 57 kW
    e. 35 kV
    f. 35.7 μA

42. a. 700 μA – 0.4 mA = 700 μA – 400 μA = 300 μA or 700 μA – 0.4 mA = 0.7 mA – 0.4 mA=0.3 mA
    b. $600 \text{ MW} + 300 \times 10^4\text{W} = 600 \text{ MW} + 3 \text{ MW}$
    $= 603 \text{ MW}$

44. $1.15 \times 10^5 \text{ V} = 115 \times 10^3 \text{ V} = 115 \text{ kV}$

46. $I_4 = 1.25 \text{ mA} + 350\ \mu\text{A} + 250 \times 10^{-5} \text{ A}$
$= 1.25 \text{ mA} + 0.35 \text{ mA} + 2.50 \text{ mA}$
$= 4.10 \text{ mA}$

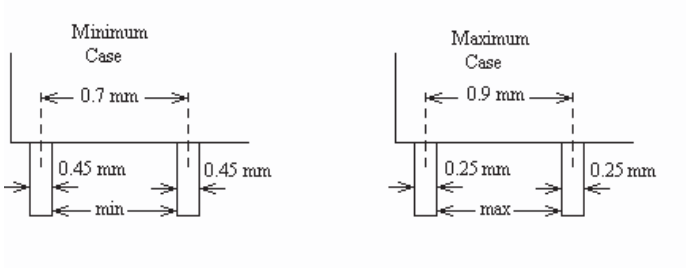
48. $V_4 = -V_1 + V_2 - V_3 = -120 \text{ mV} + 5 \text{ mV} - 2 \text{ mV}$
$= -117 \text{ mV}$

50. a. $$0.045 \text{ C} \times \frac{6.24 \times 10^{18} \text{electrons}}{\text{C}}$$
$$= 2.81 \times 10^{17} \text{ electrons}$$
    b. $$\frac{9.36 \times 10^{19} \text{ electrons}}{\text{s}} \times \frac{1.602 \text{ C}}{\text{electron}} = 15 \text{ C/s}$$
$$\therefore \frac{15\text{C}}{\text{s}} \times 20\ \mu\text{s} = 300\ \mu\text{C}$$

52. a. $P = V \times I = (50 \text{ V})(24 \text{ mA}) = 1200\text{mW} = 1.2 \text{ W}$
    b. $P_{max} = V_{max} \times I_{max} = (50.1 \text{ V})(24.1 \text{ mA}) = 1.21 \text{ W}$
    $P_{min} = V_{min} \times I_{min} = (49.9 \text{ V})(23.9 \text{ mA}) = 1.19 \text{ W}$
    Thus P lies somewhere between 1.19 W and 1.21 W.

1.7 Circuit Diagrams

54. As shown, the spacing between pins can be as small as 0.7 mm or as large as 0.9 mm, and the pins can be as large as 0.45 mm or as small as 0.25 mm, yielding the min and max separation cases illustrated. Thus, min = $0.7 - \frac{0.45}{2} - \frac{0.45}{2}$ = 0.255 mm and max = $0.9 - \frac{0.25}{2} - \frac{0.25}{2} = 0.65$ mm



https://ebookyab.ir/solution-manual-circuit-analysis-robbins-miller/
Email: ebookyab.ir@gmail.com, Phone:+989359542944 (Telegram, WhatsApp, Eitaa)

CHAPTER

2

Voltage and Current

2.1 Atomic Theory

2. a. Force is proportional to the product of charges. Therefore, the force increases by a factor of four.

   b. Force is inversely proportional to distance squared. Therefore, the force falls off to $\left(\frac{1}{3}\right)^2 = \frac{1}{9}$ of its original value.

4. The material with one valence electron.

6. a. It oxidizes less than other materials and makes better electrical contact.

   b. It is light in weight and is used for overhead power transmission lines.

2.2 The Unit of Electrical Charge: The Coulomb

8. It has an excess or deficiency of electrons.

10.
$$F = \frac{(9\times10^9)(1)(1)}{(0.25)^2} = 144\times10^9 \text{ N}$$
$$144\times10^9 \text{ N} \times \frac{1 \text{ lb}}{4.448 \text{ N}} \times \frac{1 \text{ ton}}{2000 \text{ lb}}$$
$$= 16.2 \text{ million tons}$$

12.
$$1.63\times10^{-6} \text{ C} \times \frac{6.24\times10^{18} \text{ electrons}}{\text{C}}$$
$$= 10.2\times10^{12} \text{ electrons}$$

14.
$$47\times10^{-6} \text{ C} \times \frac{6.24\times10^{18} \text{ electrons}}{\text{C}}$$
$$= 293\times10^{12} \text{ electrons}$$

16. When you slide off the chair, you strip electrons from their parent atoms. This leaves you with a net charge. Since the other person is uncharged, a potential difference exists and a shock results.

2.3 Voltage

18.
$$Q = 9.36\times10^{19} \text{ electrons} \times \frac{1.602\times10^{-19} \text{ C}}{\text{electron}} = 15 \text{ C}$$
$$V = \frac{W}{Q} = \frac{600 \text{ J}}{15 \text{ C}} = 40 \text{ V}$$

20. $W = QV = (20\times10^{-3} \text{ C})\,(70.3 \text{ V}) = 1.41 \text{ J}$

22. $W = QV = (1.6\times10^{-19} \text{ C})\,(100 \text{ V}) = 1.6\times10^{-17} \text{ J}$

2.4 Current

24.
$$I = \frac{Q}{t} = \frac{27 \text{ C}}{9 \text{ s}} = 3 \text{ A}$$

26. $Q = It = (4 \text{ A})(7\times10^{-3} \text{ s}) = 28 \text{ mC}$

28.
$$t = \frac{Q}{I} = \frac{100\times10^{-6} \text{ C}}{25\times10^{-3} \text{ A}} = 4 \text{ ms}$$

30. a. $q_1 = 10(5) + 4 = 54 \text{ C}$

    b. $q_2 = 10(8) + 4 = 84 \text{ C}$

    c. $\Delta q = 30 \text{ C}; \Delta t = 3 \text{ s}$
    $$\therefore I = \frac{\Delta q}{\Delta t} = \frac{30 \text{ C}}{3 \text{ s}} = 10 \text{ A}$$

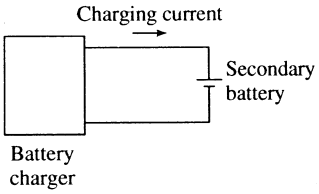
32.
$$Q = 312\times10^{19} \text{ electrons} = 500 \text{ C}$$
$$t = \frac{Q}{I} = \frac{500 \text{ C}}{8 \text{ A}} = 62.5 \text{ s}$$

2.5 Practical DC Voltage Sources

34. DC current is current that always flows in one direction while dc voltage is voltage that does not change polarity. AC current is current that alternately changes direction while ac voltage is voltage whose polarity alternately cycles between positive and negative.

https://ebookyab.ir/solution-manual-circuit-analysis-robbins-miller/
Email: ebookyab.ir@gmail.com, Phone:+989359542944 (Telegram, WhatsApp, Eitaa)

36.



You can't charge a primary battery.

38. At 25°C, Capacity = (1.5 A)(17 h) = 25.5 Ah

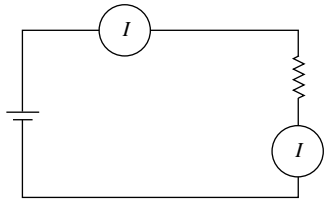
At 5°C, Capacity = (0.9)(25.5) = 22.95 Ah

$$\text{Life} = \frac{22.95\ \text{Ah}}{0.8\ \text{A}} = 28.7\ \text{h}$$

2.6 Measuring Voltage and Current

40. a. 25 V
    b. 25 V
    c. 14 V
    d. –6 V

42.



44. Voltage appears "across" components.

2.7 Switches, Fuses, and Circuit Breakers

46.