Appendix E ANSWERS

This section includes answers to section questions and questions in Chapter and Unit Reviews that require calculation.

Unit 1 Organic Chemistry

Chapter 1 Organic Compounds

Section 1.3 Questions

5. 17% greater

Section 1.6 Questions

10. 0.003 mol/L

Lab Exercise 1.3.1: Preparation of Ethyne

(c) 0.050 mol Ca(OH)2
(d) 1.30 g
(e) 47.2%

Chapter 1 Self-Quiz

1. False
2. False
3. True
4. False
5. True
6. (b)
7. (b)
8. (a)
9. (e)
10. (b)
11. (c)
12. (e)
13. (c)
14. (e)
15. (c)

Chapter 1 Review

15. (b) 87.0%

Chapter 2 Polymers – Plastics, Nylons, and Food

Chapter 2 Self-Quiz

1. False
2. True.
3. True.
4. False
5. False
6. (d)
7. (d)
8. (b)
9. (e)
10. (c)
11. (d)
12 (b)
13. (b)
14. (e)
15. (c)

Unit I Self-Quiz

1. False
2. True
3. False
4. False
5. False
6. True
7. False
8. False
9. False
10. True
11. (d)
12. (e)
13. (b)
14. (e)
15. (d)
16. (c)
17. (c)
18. (d)
19. (d)
20. (a)
21. (c)
22. (d)
23. (c)
24. (b)
25. (e)
26. (e)

Unit 1 Review

28. theoretical yield: 47.6 g; percent yield: 73.9%

Unit 2 Structure and Properties

Are You Ready?

6. hydrogen atom: 1,1,0
sodium atom: 11, 11, 0
chlorine atom: 17, 17, 0
hydrogen ion: 1, 0, 1+
sodium ion: 11, 10, 1+
chloride ion: 17, 18, 1–

Chapter 3 Atomic Theories

Section 3.3 Questions

6. (a) 3.6×10^{-19} J
(b) 3.6×10^{-19} J
7. (a) UV: 9.9×10^{-19} J; IR: 2.2×10^{-19} J
(b) 4.5:1

Section 3.4 Questions

13. (a) 485 nm.
(b) 6.19×10^{14} Hz
(c) 4.1×10^{-19} J
(d) 654 nm; 4.59×10^{14} Hz; 3.0×10^{-19} J
(e) 1.1×10^{-19} J

Section 3.6 Questions

1. (a) 2
(b) 8
(c) 18
(d) 32
2. (a) 1; 2
(b) 3; 6
(c) 5; 10
(d) 7; 14

Activity 3.4.2 The Hydrogen Line Spectrum and the Bohr Theory

(a) 410 nm, 434 nm, 486 nm, and 655 nm
(b) 656 nm
For H $n_i = 4$, $n_f = 2$, wavelength = 486 nm
For H $n_i = 5$, $n_f = 2$, wavelength = 434 nm
For H $n_i = 6$, $n_f = 2$, wavelength = 410 nm

Chapter 3 Self-Quiz

1. False
2. False
3. False
4. True
5. True
6. False
7. False
8. True
9. True
10. True
11. False
12. (b)
13. (d)
14. (a)
15. (c)
16. (c)
17. (b)
18. (e)
19. (d)

Chapter Review

16. (a) 2
(b) 8
(c) 18
(d) 32

Chapter 4 Chemical Bonding

Chapter 4 Self-Quiz

1. False
2. True
3. False
4. False
5. False
6. False
7. True
8. False
9. False
10. True
11. (e)
12. (b)
13. (d)
14. (a)
15. (c)
16. (e)
17. (c)
18. (a)
19. (b)
10. (d)

Unit 2 Self-Quiz

1. False
2. True
3. True
4. True
5. False
6. False
7. True
8. False
9. True
10. True
11. False
12. True
13. False
14. False
15. True
16. True
17. True
18. False
19. True
20. (e)
21. (b)
22. (c)
23. (a)
24. (a)
25. (a)
26. (c)
27. (d)
28. (b)
29. (d)
30. (b)
31. (e)
32. (a)
33. (b)
34. (c)
35. (e)
36. (c)
37. (b)
38. (c)
39. (a)
40. (d)

Unit 2 Review

34. (b) 7.8%
43. red – 4.29×10^{14} Hz; blue – 7.50×10^{14} Hz
44. highest – 4.97×10^{-19} J; lowest – 2.84×10^{-19} J
46. UV – 6.63×10^{-19} J; orange – 3.32×10^{-19} J

Unit 3 Energy Changes and Rates of Reaction

Are You Ready?

4. (c) 12540 J or 12 kJ
8. (b) 2.5 mol $NaHCO_3$/min
(c) 10 mol
(d) 2.5 mol CO_2/min

Chapter 5 Thermochemistry

Section 5.2 Questions

1. (a) 7.8 MJ
   (b) 2.08 MJ
2. 12°C
3. 1.50 g
4. 242 kJ

Section 5.3 Questions

4. (a) –11.0 MJ/mol
   (d) 17%

Section 5.4 Questions

1. (b) –247.5 kJ
2. –78.5 kJ
3. 492 kJ
4. (b) Experiment 1:–20.9 kJ; Experiment 2: –34.3 kJ; Experiment 3: –56.0 kJ/mol
   (c) 1.4 %

Section 5.5 Questions

2. (a) 100.7 kJ
   (b) –1411 kJ
   (c) –5640 kJ
3. (b) –96.6 kJ
4. (a) –1.79 MJ/mol acetone
   (b) –1.5 MJ/mol acetone
   (c) 16%

Lab Exercise 5.5.1 Testing Enthalpies of Formation

(a) – 726 kJ
(b) –597 kJ/mol
(c) 18%

Chapter 5 Self-Quiz

1. False
2. False
3. True
4. False
5. True
6. True
7. False
8. True
9. False
10. True
11. (c)
12. (b)
13. (e)
14. (c)
15. (c)
16. (c)
17. (d)
18. (a)

Chapter 5 Review

2. 1.10 J/(g•°C)
4. 170 kJ
5. 547 g
9. (c) –253.9 kJ
10. 206 kJ
11. 25.7 g
12. –117 kJ
13. (a) 382.8 kJ/mol NH_3
    (b) 2.25×10^4 kJ
    (c) 6.25 m^2
14. –264 kJ
15. –388.3 kJ/mol
16. (c) – 55 kJ
    (d) +19 kJ
18. (a) –44 kJ
    (b) –285.5 kJ/mol
    (c) -1.7×10^9 kJ
    (d) $\Delta H_{condenstion}$: 0.4 cm; $\Delta H^\circ_{f(H_2O_{(l)})}$: 3 cm; ΔH_{fusion}: 1000 km

Chapter 6 Chemical Kinetics

Section 6.1 Questions

1. (a) 1.2 mol/(L•s)
   (b) 2.5 mol/(L•s)
   (c) 1.2 mol/(L•s)
   (d) 2.5 mol/(L•s)

Section 6.3 Questions

2. (a) 1 with respect to $Cl_{2(g)}$; 2 with respect to $NO_{(g)}$
   (b) × 2
   (c) × 9
   (d) 3.0 L/(mol•s)
   (e) $8.2(5) \times 10^{-4}$ mol/(L•s)
3. (b) 0.495 a
   (c) 2.5 g
4. (a) 0.039 g

Section 6.4 Questions

3. (a) 60 kJ
   (b) –35 kJ

Lab Exercise 6.1.1

(c) (i) 0.4 mol/(Lmin)
    (ii) 0.075 mol/(Lmin)
(d) (i) 0.41 mol/(Lmin)
    (ii) 0.075 mol/(Lmin)

Chapter 6 Self-Quiz

1. False
2. True
3. False
4. True
5. True
6. False
7. True
8. True
9. False
10. False
11. (b)
12. (e)
13. (d)
14. (c)
15. (a)
16. (b)
17. (d)
18. (b)

Chapter 6 Review

3. 80 mL/s
5. (a) 1.47 mL/s
7. (c) 18 $L^2/(mol^2•s)$
   (d) 0.65 mol/(L•s)
8. (b) 6.25%

Unit 3 Self-Quiz

1. False
2. True
3. False
4. True
5. False
6. True
7. True
8. False
9. False
10. True
11. (b)
12. (c)
13. (e)
14. (a)
15. (e)
16. (c)
17. (b)
18. (d)
19. (b)
20. (e)
21. (b)
22. (a)
23. (c)
24. (c)
25. (e)
26. (c)
27. (b)
28. (d)
29. (c)
30. (d)

Unit 3 Review

1. 340 kJ
2. 657 kJ
3. (a) –5.57 kJ/mol
5. (c) 44.6 kJ
6. –2572.4 kJ
7. (b) –3536.3 kJ
   (c) 982 kJ
9. (b) 0.130 mol/L
11. (b) 0.80; 1.30; 1.80; 2.20
    (c) (i) 0.092 mol/(L•h)
        (ii) 0.18 mol/(L•h)
        (iii) 0.046 mol/(L•h)
    (d) 0.14 mol/(L•h); 0.058 mol/(L•h)
14. (b) 2.0×10^{-2} mol/(L•s) for $[O_{2(g)}]$; 1.2×10^{-2} mol/(L•s) for $[CO_{2(g)}]$
20. (a) –1.96 MJ/mol
21. (a) –104 kJ/mol
22. (a) –125.7 kJ/mol
27. (b) efficient –5470 kJ; non-efficient –3942 kJ
    (c) 28%
    (d) 3.7×10^2 g
    (e) 6.1×10^2 g

Unit 4 Chemical Systems and Equilibrium

Are You Ready?

(page 420)

2. (b) 0.1 mol $MgCl_2$
   (c) 0.4 mol/L
4. –1923.7 kJ/mol
5. (b) 0.027 mol/L
6. (g) 15.00 mL NaOH
   (h) 7
   (j) 1.0×10^{-7} mol/L
7. (a) 26
   (b) 0.28
   (c) 0.52 or –1.7

Chapter 7 Chemical Systems in Equilibrium

Section 7.1 Questions

3. (a) 2.00 mol
   (b) 70.0%
4. (a) $[C_2H_4] = 2.50$ mol/L; $[Br_2] = 1.00$ mol/L; $[C_2H_4Br_2] = 1.50$ mol/L
   (c) 60.0%
7. (a) 0.0 mol HI; 8.0 mol I_2; 12.0 mol H_2
   (b) 14 mol HI
   (c) 88%
8. $[PCl_5] = 0.90$ mol/L; $[Cl_2] = 0.10$ mol/L
9. (a) $[CO] = 0.0600$ mol/L; $[CH_3OH] = 0.0400$ mol/L
   (b) 40.0%

Section 7.2 Questions

2. 49.70
3. 0.46
4. 3.9×10^{-4} mol/L
6. (c) 0.200 mol
   (d) 0.800 mol HBr
   (e) 0.400 mol H_2, 0.400 mol Br_2
   (f) 0.200 mol/L
   (g) 4.00

Section 7.5 Questions

2. 1.5
3. (a) $[HBr] = 0.78$ mol/L; $[H_2] = [Br_2] = 0.011$ mol/L
   (b) 0.39 mol HBr, 0.055 mol H_2, 0.055 mol Br_2
   (c) 78%
4. $[H_2] = 0.010$ mol/L; $[I_2] = 0.31$ mol/L; $[HI] = 0.38$ mol/L
5. $[NO_2] = 1.66$ mol/L
6. (a) $[HCl] = 0.38$ mol/L; $[H_2] = [Cl_2] = 1.81$ mol/L
   (b) 0.285 mol HCl; 1.36 mol H_2; 1.36 mol Cl_2
   (c) 9.50%
7. $[CO] = [Cl_2] = 0.25$ mol/L
8. $[PCl_5] = 0.199$ mol/L; $[Cl_2] = [PCl_3] = 0.480$ mol/L

Section 7.6 Questions

4. 1.0×10^{-5} mol/L
5. 1.4×10^{-5} g/100 mL
6. 2.0×10^{-3} mol/L
7. 1.0×10^{-2}
8. 3.4×10^{-11}
9. 1.7×10^{-4} g
10 (a) 6.0×10^{-4}
   (b) 2.8×10^{-11}
   (c) 5.6×10^{-9}
11. 8.5×10^{-7} mol/L

12. (a) 1.4×10^{-3} mol
    (b) 1.4×10^{-2} mol/L
    (c) 1.2×10^{-5}
13. (a) 2.5×10^{-3} mol
    (b) 5.0×10^{-3} mol
    (c) 5.0×10^{-2} mol/L
    (d) 2.5×10^{-3}

Section 7.7 Questions

11. (a) –207.5 kJ
    (b) +803.8 kJ
12. 300°C
13. (b) $\Delta H°$ = –176.2 kJ; $\Delta S°$ = –284.8 J/K•mol ; $\Delta G°$ = –91.3 kJ
14. (a) –1314.4 kJ
19. (a) 387 K

Chapter 7 Self-Quiz

1. False
2. True
3. False
4. True
5. False
6. False
7. False
8. True
9. True
10. True
11. (e)
12. (a)
13. (c)
14. (b)
15. (d)
16. (a)
17. (a)
18. (a)
19. (c)
20. (e)

Chapter 7 Review

10. (b) 2.9×10^{-3} mol/L
15. (a) $[H_2]$ = 1.46 mol/L; $[Br_2]$ = 1.46 mol/L; [HBr] = 5.07 mol/L
    (b) $[H_2]$ = 2.20 mol/L; $[Br_2]$ = 2.20 mol/L; [HBr] = 2.61 mol/L
    (c) $[H_2]$ = 3.00 mol/L; $[Br_2]$ = 1.00 mol/L; [HBr] = 6.00 mol/L
17. 1.61×10^{-10}
18. 4.8×10^{-5} mol/L

Chapter 8 Acid–Base Equilibrium

Section 8.1 Questions

4. 0.018 g

Section 8.2 Questions

2. 11.23
3. 6×10^{-3}%
4. 6.3×10^{-5}
5. 7×10^{-4}
6. 4.65
10. (b) atropine 11.25; morphine 10.45; erythromycin 10.90
11. 7.7×10^{-10}
12. 1.4×10^{-11}
13. 10.27
15 (b) NH_3 1.7×10^{-5}; HS^- 9.1×10^{-8}; SO_4^{2-} 1.0×10^{-12}
16. 1.6×10^{-6}
17. 11.124
18. 8.46
21. (a) 4.2×10^{-10}
23. (a) 3.20

Section 8.4 Questions

7. (a) 2.600
   (b) 4.025
   (c) 10.450
9. (a) (i) 5.206
   (ii) 8.883
   (iii) 4.283
10. 12.25

Section 8.5 Questions

9. 61 increase

Chapter 8 Self-Quiz

1. False
2. False
3. True
4. True
5. False
6. False
7. False
8. False
9. True
10. (b)
11. (b)
12. (e)
13. (a)
14. (b)
15. (c)
16. (e)
17. (a)
18. (b)
19. (a)

Chapter 8 Review

1. 0.372
2. (a) pH = 0.0161; pOH = 13.984
4. $[H^+_{(aq)}] = [F^-_{(aq)}] = 3.6 \times 10^{-2}$
5. $[H^+_{(aq)}] = 4.0 \times 10^{-8}$; pH = 7.40
6. pH = 2.421; pOH = 11.579
7. (a) 2.644
8. (b) $[H^+_{(aq)}] = 7.9 \times 10^{-6}$; pH = 5.10
9. 1.3×10^{-10}
14. 0.537 mol/L
15. (a) 5.27
    (b) 11.12
    (c) 9.26
    (e) 5.27
    (f) 1.70
25. 1.79

Unit 4 Self-Quiz

1. False
2. True
3. True
4. False
5. False
6. False
7. True
8. True
9. False
10. False
11. False
12. False
13. False
14. False
15. True
16. True
17. False
18. False
19. False
20. True
21. False
22. True
23. (b)
24. (b)
25. (e)
26. (b)
27. (b)
28. (c)
29. (b)
30. (e)
31. (c)
32. (c)
33. (d)
34. (c)
35. (e)
36. (c)
37. (b)
38. (b)
39. (d)
40. (d)
41. (e)

Unit 4 Review

1. 3.58×10^{-3}
2. 1.7×10^{-3}
6. (a) 1.3×10^{-5} mol/L
   (b) 1.2×10^{-8} mol/L
8. 7.91 mol/L
10. (a) $[H_2] = [CO_2]$ = 0.044 mol/L; $[H_2O] = [CO]$ = 0.056 mol/L
    (b) 1.6
11. (a) $[PCl_5]$ = 0.040 mol/L; $[PCl_3] = [Cl_2]$ = 0.26 mol/L
    (b) 1.7
12. $[H_2] = [I_2]$ = 0.0221 mol/L; [HI] = 0.156 mol/L
13. [NH3] = 0.14 mol/L; $[N_2]$ = 0.032 mol/L; $[H_2]$ = 0.097 mol/L
14. 0.375 mol/L
15. 3.255×10^{-3} mol/L
16. 8.4×10^{-3} mol/L
17. 0.029 mol/L
24. –7.7 kJ
25. –801.2 kJ
26. 348 K
29. 40:1
30. $[H^+_{(aq)}] = 2 \times 10^{-3}$ mol/L; $[OH^-_{(aq)}] = 5 \times 10^{-12}$ mol/L
31. 3.5×10^{-6}
34. 4.27
38. (b) 12.58
43. (a) 7.000
    (b) 1.000
    (c) 1.477
    (e) 7.000
    (f) 12.301
44. (a) 1.000
    (b) 1.477
    (c) 3.601
    (d) 4.602
    (e) 9.400
    (f) 12.046
52. 0.62 decrease
53. (a) 8.0×10^{-4} mol
    (b) 0.016 mol/L
    (c) 0.032 mol/L
    (d) 0.016 mol/L
    (f) 1.6×10^{-5}
54. (a) 1.740×10^{-4} mol
    (b) 0.38 g
    (c) 84 %
55. (a) 0.185 mol/L
58. (a) pOH = 0.0969; pH = 13.903
62. (a) 7.1×10^{-5} mol/L
    (b) 350
64. (a) 7.1×10^{-5} mol/L
    (b) 352

Unit 5 Electrochemistry
Chapter 9 Electric Cells

Section 9.2 Questions

7. 75.5 mmol/L

Section 9.5 Questions

6. +0.48 V
7. (a) +1.10 V
   (b) +1.37
8. –0.28 V

Chapter 9 Self-Quiz

1. True
2. False
3. True
4. False
5. False
6. True
7. False
8. True
9. True
10. (a)
11. (d)
12. (c)
13. (a)
14. (b)
15. (d)
16. (c)
17. (e)
18. (b)

Chapter 9 Review

14. (a) +0.71 V
    (b) +0.62 V
15. (a) +0.48 V
    (b) +0.48 V
    (c) +1.77 V
16. (b) +0.14 V
18. +1.54 V
22. (c) +0.47 V
25. (a) +0.23 V

Chapter 10 Electrolytic Cells

Section 10.1 Questions

5. (a) $\Delta E^\circ = -0.50$ V
   (b) $\Delta E^\circ = -0.03$ V
   (c) $\Delta E^\circ = -0.47$ V
6. (a) 0.43 V
   (b) 0.29 V
7. (a) −1.30 V

Section 10.3 Questions

1. 2.80 mmol
2. 0.58 Mg or 0.58 t
3. 82.8 min
4. 52.8 kA
5. (a) 1.63 Mg or 1.63 t
   (b) 4.76 Mg or 4.76 t
6. 0.174 mol/L
7. 24.42 g

Chapter 10 Self-Quiz

1. True
2. False
3. False
4. True
5. True
6. True
7. False
8. (e)
9. (a)
10. (b)
11. (d)
12. (b)
13. (e)
14. (c)
15. (a)
16. (d)

Chapter 10 Review

4. (a) 1.22 V
   (b) 0.80 V
   (c) 0.00 V
5. (a) 1.90 V
   (b) 1.23 V
   (c) 1.51 V
6. (b) 1.23 V
10. (b) 2.19 V
11. (c) 0.889 g
12. Al: 0.629 g; Ni: 2.05 g; Ag: 7.54 g
13. (a) 7.42×10^3 s
    (b) 4.05×10^3 s
    (c) 4.34×10^3 s
14. (a) 1.99 V
    (b) 590 s
15. 2.98 kA
16. 20.1 min
17. 1.03 kmol/h
18. (a) 1.8 A
    (b) 2%

Unit 5 Self-Quiz

1. True
2. False
3. False
4. True.
5. False
6. True
7. True
8. False
9. True
10. False
11. False
12. True
13. False
14. True
15. True
16. True
17. False
18. False
19. (b)
20. (e)
21. (c)
22. (c)
23. (d)
24. (e)
25. (b)
26. (d)
27. (a)
28. (d)
29. (e)
30. (b)
31. (c)
32. (a)
33. (c)
34. (d)
35. (a)
36. (b)

Unit 5 Review

3. (a) −2
   (b) +4
   (c) +6
   (d) +4
   (e) 0
4. (a) Sn +4; Co 0; Sn 2+; Co +2
   (b) Fe +3; Zn 0; Fe +2; Zn +2
   (c) Cl 0; I −1; Cl −1; I 0
   (d) C +3; O −2; Mn +7; O −2; H +1; C +4; O −2; Mn +2; H +1; O −2
   (e) Cl 0; S +4; O −2; O −2; H +1; Cl −1; S +6; O −2 H +1, O −2

Appendix D

Chemistry 11 Review

Unit 2 Quantities in Chemical Reactions

1. (a) 28.02 g/mol
   (b) 114.26 g/mol
   (c) 32.00 g/mol
   (d) 182.71 g/mol
   (e) 187.42 g/mol
   (f) 285.75 g/mol
   (g) 4.00 g/mol
   (h) 80.06 g/mol
   (i) 17.04 g/mol
   (j) 36.46 g/mol
2. (a) 6 mol
   (b) Fe: 2 mol; N: 3 mol; O: 9 mol
   (c) K: 9 mol; Cr 9 mol; O: 31.5 mol
   (d) 3 mol
   (e) N: 10 mo; H: 40 mol; S: 5 mol; O: 20 mol
3. (a) 146 g
   (b) 45.0 g
   (c) 216 mg
   (d) 126 g
   (e) 0.803 g
4. (a) 0.555 mol
   (b) 14.7 mol
   (c) 1.43×10^{-5} mol
   (d) 5.94×10^{-6} mol
   (e) 16.6 mol
5. (a) H: 2.06%; S: 32.69%; O: 65.25%
   (b) Ag: 63.498%; N 8.247%; O: 28.26%
   (c) N: 35.00%; H: 5.05%; O: 59.96%
10. (a) 7.5 mol
    (b) 12.5 mol
11. (b) 5.144 g
    (c) 2.04 g
12. (b) 250.3 g.
    (c) 189.0 g
13. (c) 14.4 g
    (d) 15.8 g
15. (d) 132.9 g
16. (a) 945 g.
    (b) 762.3 g
17. (a) 8.82 g.
    (b) 1.44 g
18. (a) 25.98 g
    (b) 68.98%
19. (a) 0.259 g
    (b) 73%

Unit 3 Solutions and Solubility

2. (a) 0.696 mol/L
   (b) 2.00 mol/L
   (c) 0.664 mol/L
3. 0.25 L
4. 6.4 g
5. 119 g
6. 0.390 mol/L
7. (a) 0.640 mol/L
   (b) 1.28 mol/L
   (c) 0.640 mol/L
8. 4.98×10^{-3} mol
9. 4.69 g
10. 0.348 mol/L
11. 24.2 mL
12. (a) 1.00×10^3 g
    (b) 55.5 mol
    (c) 55.5 mol/L
14. (c) 0.381 g
15. (b) 0.11 mol/L
17. (a) 2
    (b) 10.35
    (c) 2.26
    (d) 9.14
18. (a) 1.0×10^{-5} mol/L
    (b) 8×10^{-3} mol/L
    (c) 1.6×10^{-10} mol/L
    (d) 1.0×10^{-7} mol/L
22. 0.146 mol/L
23. 0.0105 mol/L
24. 0.0775 mol/L
25. 0.112 mol/L
26. 32.4 mL
27. 0.180 mol/L

Unit 4 Gases and Atmospheric Chemistry

1. 2.39 L
2. 1.78 L
3. 180 kPa
4. 3.25 L
5. 6.98 L
6. 82.6 L
7. 186 kPa
8. 0.092 mol
9. 2660 L
10. 27.96 g/mol
11. 1.3 g
12. (a) 25.0 L
    (b) 50.0 L
13. 95.6 kPa
14. 0.732 g
15. (b) 981 L

Unit 5 Hydrocarbons and Energy

7. 376 kJ
8. 1.06×10^3 kJ
9. (b) 2.3 kJ/g
   (c) 140 kJ/mol
10. (b) 728 kJ/mol