Answer Key for Atkins' - 8th Edition - "A" problems only & 7th edition - "B" problems only
Up to end of Lecture 9 - October 10, 2007 Minor edit: 1.18 Version 2

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For some unknown reason, Atkins et al. switched the B list problems for student solutions manual and the A list problems for the instructors...and they have cancelled many questions in edition 8 from the 6th and 7th editions. The exercises with "M" in front of them are described in the exercise handouts on the web. "P" refers to a "Problem" and "ST" to a "Self-Test" in the textbook.

Lecture 1:

8th edition A-list questions: M1.1, 1.2, M1.3, 1.4, 1.7

M1.1

1.2 (a) 3.42 bar; (b) 3.38 atm

M1.3

1.4 4.20×10^{-2} atm

1.7 $R = 8.3147$ J K^{-1} mol^{-1}

7th edition B-list questions: 1.4, 1.6, 1.7, 1.9, 1.10

1.4 830 kPa

1.6 (a) 8.04 x 10^2 Torr (b) 1.07 bar

1.7 92.4 K

1.9 2.67 x 10^3 kg

1.10 0.0820414 L atm K^{-1} mol^{-1}, $M = 31.9987$ g mol^{-1}

Lecture 2

8th edition A-list questions: 1.8, 1.10, 1.11, 1.18, 1.5, P1.1, P1.28

1.8 $M = 256$ g mol^{-1}, formula for molecule in vapor is S_8

1.10 (a) $p_{O2} = 179$ Torr; (b) partial pressures are: $p_{N2} = 577$ Torr, $p_{O2} = 155$ Torr and $p_{Ar} = 7$ Torr

1.11 169 g mol^{-1}

1.18 (a) $x_{H2} = 0.67$, $x_{N2} = 0.33$; (b) $p_{H2} = 2.0$ atm, $p_{N2} = 1.0$ atm; (c) 3.0 atm

1.5 0.50 m^3

P1.1 see manual

P1.28 (a) 4.62×10^3 mol; (b) 1.3×10^2 kg; (c) 1.2×10^2 kg

7th edition B-list questions: 1.11, 1.13, 1.14, 1.22, P1.1, P1.3, P1.30

1.11 P_4

1.13 (a) 3.14 L (b) 212 Torr

1.14 16.4 g mol^{-1}

1.22 (a) $x_{N2} = 0.63$, $x_{H2} = 0.37$ (b) $p_{N2} = 2.5$ atm, $p_{H2} = 1.5$ atm (c) 4.0 atm

P1.1 0.50 m^3

P1.3 see manual

P1.30 see manual

Lecture 3

8th edition A-list: 21.1, 21.2, 21.7, Self-Test 21.1 (p. 752), P21.23, 21.3, 21.4, 21.5, 21.6

21.1 (a) 9.975; (b) 1

21.2 (a) 72 K; (b) 9.5×10^2 m s^{-1}; (c) T would not be different if O_2 molecules exerted the same p in the same V, but their rms speed would be different

21.7 9.06×10^{-3}

21.3 0.081 Pa

21.4 9.7×10^{-7} m

21.5 (a) 5×10^{10} s^{-1}; (b) 5×10^9 s^{-1}; (c) 5×10^3 s^{-1}; $z \propto p$ at const. T

21.6 (a) 6.7 nm; (b) 67 nm; (c) 6.7 cm

7th edition B-list: 24.4, 24.5, 24.10, Self-Test 24.1 (p. 820), P24.23, 24.6, 24.7, 24.8, 24.9

24.4 (a) 7.079 (b) 1

24.5 (a) 4.75×10^2 m s^{-1} (b) 4.4×10^4 m (c) 1×10^{-2} s^{-1}

24.6 2.4×10^7 Pa

24.7 4.1×10^{-7} m

24.8 9.9×10^8 s^{-1}

24.9 (a) 3.7×10^{-9} m (b) 5.5×10^{-8} m (c) 4.1×10^{-5} m

24.10 0.092

Lecture 4

8th edition A-list: 1.1, 1.13, 1.15, 1.16, 1.17, 1.19, 1.20 1.21, P1.17, P1.20

1.1 (a) 24 atm; (b) 22 atm

1.13 (a-i) 1.0 atm (a-ii) 820 atm (b-i) 1.0 atm (b-ii) 1700 atm

1.15 (a) $Z = 0.88$; (b) $V_m = 1.2$ L mol^{-1}

1.16 140 atm

1.17 (a) 50.7 atm; (b) 35.2 atm, $Z = 0.695$

1.19 $b = 32.9$ cm^3 mol^{-1}, 1.33 L^2 atm mol^{-2}, 0.24 nm

1.20 (a) 1.41×10^3 K; (b) 0.59 nm

1.21 (a) $p = 8.7$ atm, $T = 3.64 \times 10^3$ K (b) $p = 4.5$ atm, $T = 2.60 \times 10^3$ K (c) $p = 0.18$ atm, $T = 46.7$ K

P1.17 see manual

P1.20 see downloads page - covered in class

7th edition B-list: 1.5, 1.16, 1.18, 1.19, 1.21, 1.23, 1.24, 1.25, P1.20, P1.23

1.5 (a) 10.5 bar; (b) 10.4 bar

1.16 (a-i) 1.0 atm (a-ii) 270 atm (b-i) 0.99 atm (b-ii) 190 atm

1.18 (a) 1.12 (b) 2.7 L mol^{-1} - repulsive forces dominate

1.19 (a) 0.124 L mol^{-1} (b) $x = 0.112$ or $V_m = 0.112$ L mol^{-1}

1.21 (a) 8.7 mL (b) -0.15 L mol^{-1}

1.23 $a = 0.0493$ L mol^{-1}, $b = 3.16$ L^2 atm mol^{-1}, $r = 2.69$ Å

1.24 (a) 1259 K; (b) 0.129 nm

1.25 (a) $p = 2.6$ atm, $T = 881$ K (b) $p = 2.2$ atm, $T = 718$ K (c) $p = 1.4$ atm, $T = 356$ K

P1.20 see manual

P1.23 see downloads page - covered in class

Lecture 5

No questions assigned

Lecture 6

8th edition A-list: M2.1, 2.1, 2.2, 2.4, 2.5, M2.2, 2.7

M2.1

2.1 (a) 2.6×10^3 J; (b) 4.2×10^2 J

2.2 -1.0×10^2 J

2.4 1.33 atm, +1.25 kJ

2.5 (a) $w = -88$ J; (b) $w = -167$ J

M2.2

2.7 -1.5 kJ

7th edition B-list: 2.4, 2.5, 2.6, 2.8, 2.9, 2.10, 2.12

2.4 (a) 4.9×10^3 J (b) 1.9×10^3 J

2.5 59 J

2.6 -91 J

2.8 $p_2 = 1.41$ atm, $\Delta U = 3.28 \times 10^3$ J, $q = 3.28 \times 10^3$ J, $w = 0$ J

2.9 (a) -19 J (b) -53 J

2.10 6.01 J

2.12 -190 J

Lecture 7 - Set I

8th edition A-list: 2.3, 2.8, 2.9, 2.10, 2.11, M2.3, 2.12

2.3 (a) $\Delta U = \Delta H = 0$, $w = -1.57$ kJ, $q = +1.57$ kJ; (b) $\Delta U = \Delta H = 0$, $w = -1.13$ kJ, $q = +1.13$ kJ; (c) $\Delta U = \Delta H = 0$, $w = 0$, $q = 0$

2.8 (a) $q = \Delta H = 28.3$ kJ, $w = -1.45$ kJ, $\Delta U = +26.8$ kJ
(b) $\Delta H = 28.3$ kJ, $\Delta U = 26.8$ kJ, $w = 0$ J, $q = +26.8$ kJ

2.9 131 K

2.10 $w = -194$ J, $p_f = 22$ kPa ***note: sign of w is wrong in 7th edition

2.11 22 kPa

M2.3

2.12 $C_{p,m} = 30$ J K^{-1} mol^{-1}, $C_{V,m} = 22$ J K^{-1} mol^{-1}

7th edition B-list: 2.7, 2.14, 2.15, 2.16, 2.17, 2.18, 2.20

2.7 (a) $w = -1.62$ kJ, $q = 1.62$ kJ (b) $w = -1.38$ kJ, $q = 1.38$ kJ (c) $w = q = 0$ J

2.14 (a) $q = \Delta H = 14.9$ kJ, $w = -831$ J, $\Delta U = 14.1$ kJ
(b) $w = 0$ J, $q = \Delta U = 14.1$ kJ, $\Delta H = 14.9$ kJ

2.15 200 K

2.16 -325 J

2.17 8.5 Torr

2.18 0.46 atm

2.20 $C_{p,m} = 53 \text{ J K}^{-1} \text{ mol}^{-1}$, $C_{v,m} = 44 \text{ J K}^{-1} \text{ mol}^{-1}$

Lecture 7 - Set II

8th edition A-list: M2.4, 2.13, 2.14, M2.5, 2.15, M2.6, M2.7

M2.4

2.13 $q_p = \Delta H = +2.2$ kJ; $\Delta U = +1.6$ kJ

2.14 $q = 0$, $w = -3.2$ kJ; $\Delta U = -3.2$ kJ, $\Delta T = -38$ K, $\Delta H = -4.5$ kJ

M2.5

2.15 $V_f = 9.44 \times 10^{-3}$ m^3, $T_f = 288$ K and $w = -0.46$ kJ **incorrect in manual

M2.6

M2.7

7th edition B-list: 2.21, 2.22, 2.23, 2.24, 2.25, 2.27, 2.28

2.21 $\Delta H = -2.3$ kJ, $q = -2.3$ kJ, $C_{p,m} = 5.8$ J K^{-1} mol^{-1}

2.22 $\Delta H = q_p = 2.0 \times 10^3$ J mol^{-1}; $\Delta U = 1.6 \times 10^3$ J mol^{-1}

2.23 $q = 0$ J, $w = \Delta U = -3.5$ kJ, $\Delta T = -24$ K, $\Delta H = -4.5$ kJ

2.24 $q = 0$ J, $w = \Delta U = 2.4$ kJ, $\Delta H = 3.1$ kJ, $V_f = 14$ L, $p_f = 3.74$ atm

2.25 $V_f = 20$ L, $T_f = 279$ K, $w = -670$ J

2.27 $q = 0$ J, $w = \Delta U = -36$ J, $\Delta T = -0.58$ K, $\Delta H = -51$ J

2.28 (a) 164 K (b) 171 K

Lecture 8

8th edition A-list: 2.6, 2.16, 2.17, M2.8, 2.18, 2.19, 2.20, 2.21, M2.9, 2.22, 2.26, 2.28

2.6 $q = -40.656$ kJ, $w = +3.10$ kJ, $\Delta U = -37.55$ kJ

2.16 $q = 13.0$ kJ, $w = -1.0$ kJ, $\Delta U = 12.0$ kJ

2.17 -4564.7 kJ mol^{-1}

M2.8

2.18 $\Delta_f H^\circ((CH_2)_3g) = +53$ kJ mol^{-1}; $\Delta_r H^\circ = -33$ kJ mol^{-1}

2.19 -5152 kJ mol^{-1}, $C = 1.58$ kJ K^{-1}, $\Delta T = +0.205$ K (phenol)

2.20 +65.49 kJ mol^{-1}

2.21 -383 kJ mol^{-1}

M2.9

2.22 (a) $\Delta_r H^\circ = -114.40$ kJ mol^{-1}, $\Delta_r U^\circ = -109.44$ kJ mol^{-1}

(b) $\Delta_r H^\circ$(HCl,g) = -92.31 kJ mol^{-1}, $\Delta_r H^\circ(H_2O,g) = -241.82$ kJ mol^{-1}

2.26 (a) $\Delta_r H^\circ = +131.29$ kJ mol^{-1}, $\Delta_r U^\circ = +128.81$ kJ mol^{-1}

(b) $\Delta_r H^\circ = +132.56$ kJ mol^{-1}, $\Delta_r U^\circ = +129.42$ kJ mol^{-1}

2.28 $\Delta_{hyd}H^\circ(Mg^{2+}) = -1892.2$ kJ mol^{-1}

(from 150.5+641.32+167.2+737.7+1450.7+241.6-729.4-767.4+(-x)=0)

7th edition B-list: 2.11, 2.29, 2.30, 2.31, 2.32, 2.35, 2.36, 2.37, 2.39, 2.40, 2.44, 2.45

2.11 $q = -70.6$ kJ, $w = 5.60 \times 10^3$ J, $\Delta U = -65.0$ kJ

2.29 $\Delta H = q = 24.0$ kJ, $w = -1.6$ kJ, $\Delta U = 22.4$ kJ

2.30 -3053.6 kJ mol^{-1}

2.31 -126 kJ mol^{-1}

2.35 $C = 66.1$ J K^{-1}, $\Delta T = 66.2$ K (Using $\Delta_f H^\circ(C_{14}H_{10}) = 125.5$ kJ mol^{-1})

2.36 84.4 kJ mol^{-1}

2.37 1.9 kJ mol^{-1}

2.39 (a) -32.88 kJ mol^{-1} (b) -55.84 kJ mol^{-1}
2.40 (a) $\Delta_r H^\circ$ = -589.56 kJ mol^{-1}, $\Delta_r U^\circ$ = -587.08 kJ mol^{-1}
(b) $\Delta_r H^\circ$(HI) = 26.48 kJ mol^{-1}, $\Delta_r H^\circ(H_20)$ = -241.82 kJ mol^{-1}
2.44 (a) $\Delta_r H^\circ$ = -175 kJ mol^{-1}, $\Delta_r U^\circ$= -173 kJ mol^{-1} (b) -176 kJ mol^{-1}
2.45 -1587 kJ mol^{-1}

Transition Lecture *(selected answers)*
8th edition A-list: P2.20, M2.10, P2.21ab, P2.21c, P2.22, P2.25
P2.20 derivation
P2.22 derivation

7th edition B-list: 3.4, 3.5, 3.6, 3.7, 3.8, 3.9
3.4 see solution of 3.4(a)
3.5 $dz = [(1 + y)^{-2}]dx - [2x(1 + y)^{-3}]dy$
3.6 $dz = [3x^2 - 2y^2]dx - [4xy]dy$
3.7 $dz = [2xy + y^2]dx + [x^2 + 2xy]dy$
3.8 see solution of 3.8(a)

Lecture 9
8th edition A-list: P2.26, M2.11, 2.29, 2.30, 2.31, 2.32, 2.33, M2.12, P2.23a, P2.23b, P2.24
P2.26 derivation
M2.11
2.29 0.71 K atm^{-1}
2.30 ΔU_m = +131 J mol^{-1}, q = 8.05 kJ mol^{-1}, w = -7.92 kJ mol^{-1}
2.31 1.31×10^{-3} K^{-1}
2.32 1.1×10^3 atm
2.33 μ_T = -7.2 J atm^{-1} mol^{-1} , $q = \Delta H$ = +8.1 kJ
M2.12
P2.23a see manual
P2.23b see manual
P2.24 derivation
P2.30 derivation

7th edition B-list:3.10, 3.12, 3.13, 3.14, 3.15, 3.16, 3.17, 3.18, P3.12, P3.13, P3.14, P3.17
3.10 $d\ln p = (p\kappa_T)^{-1}(\alpha dT - dV/V)$
3.12 $\alpha = 1/T$, $\kappa_T = 1/p$
3.13 0.48 K atm^{-1}
3.14 ΔU_m = 129 J mol^{-1}, q = 7.75 kJ mol^{-1}, w = -7.62 kJ mol^{-1}
3.15 1.27 x 10^{-3} K^{-1}
3.16 360 atm
3.17 μ_T = -41.2 J mol^{-1} atm^{-1}, $q = \Delta H$ = 27.2 kJ
3.18 -3.3 atm
P3.12 derivation
P3.13 derivation
P3.14 see manual

P3.17 see manual