Answer to Some Selected Problems

UNIT 1

1.17 ~ 15 10^{-4} g , 1.25 10^{-4} *m*

1.18 (i) 4.8×10^{-3} (ii) 2.34×10^{-5} (iii) 8.008×10^{-3} (iv) 5.000×10^{-2}
(v) 6.0012×10^{-0}

1.19 (i) 2 (ii) 3 (iii) 4 (iv) 3
(v) 4 (vi) 5

1.20 (i) 34.2 (ii) 10.4 (iii) 0.0460 (iv) 2810

1.21 (a) law of multiple proportion (b) (i) Ans : (10^6 mm, 10^{15} pm)
(ii) Ans : (10^6 kg, 10^9 ng)
(iii) Ans : (10–^{3} L, 10–^{3} dm^3)

1.22 6.00×10^{-1} m =0.600 m

1.23 (i) B is limiting (ii) A is limiting
(iii) Stoichiometric mixture –No (iv) B is limiting
(v) A is limiting

1.24 (i) 2571 g (ii) 428.5g
(iii) Hydrogen will remain unreacted; 571.5 g

1.26 Ten volumes

1.27 (i) 2.87×10^{-11}pm (ii) 1.515×10^{-5} s (iii) 2.5365×10^{-2}kg

1.30 1.99265×10^{-23}g

1.31 (i) 3 (ii) 4 (iii) 4

1.32 39.948 g mol^{-1}

1.33 (i) 3.131 10^{-25} atoms (ii) 13 atoms (iii) 7.8286 10^{-24} atoms

1.34 Empirical formula CH, molar mass 22.0 g mol^{-1}, molecular formula C_2H_2

1.35 0.94 g $CaCO_3$

1.36 8.40 g HCl

UNIT 2

2.1 (i) 1.099 10^{27} electrons (ii) 5.48 10^{-7} kg, 9.65 10^4C

2.2 (i) 6.022 10^{24}electrons
(ii) (a) 2.4088 10^{21} neutrons (b) 4.0347 10^{-6} kg
(iii) (a) 1.2044 10^{22} protons (b) 2.015 10^{-5} kg

2.3 7,6: 8,8: 12,12: 30,26: 50, 38

2.4 (i) Cl (ii) U (iii) Be

2.5 5.17 10^{14} s^{-1}, 1.72 10^6m^{-1}

2.6 (i) 1.988 10^{-18} J (ii) 3.98 10^{-15} J

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2.7 6.0 10^{-2} m, 5.0 10^{9} s^{-1} and 16.66 m^{-1}

2.8 2.012 10^{16} photons

2.9 (i) 4.97 10^{-19} J (3.10 eV); (ii) 0.97 eV (iii) 5.84 10^{5} m s^{-1}

2.10 494 kJ mol^{-1}

2.11 7.18 $10^{19}s^{-1}$

2.12 4.41 $10^{14}s^{-1}$, 2.91 10^{-19}J

2.13 486 nm

2.14 8.72 10^{-20}J

2.15 15 emmission lines

2.16 (i) 8.72 10^{-20}J (ii) 1.3225 nm

2.17 1.523 10^{6} m^{-1}

2.18 2.08 10^{-11} ergs, 956 Å

2.19 3647Å

2.20 3.55 10^{-11}m

2.21 8967Å

2.22 Na^{+}, Mg^{2+}, Ca^{2+}; Ar, S^{2-} and K^{+}

2.23 (i) (a) $1s^2$ (b) $1s^2$ $2s^2$ $2p^6$; (c) $1s^22s^22p^6$ (d) $1s^22s^22p^6$

2.24 n = 5

2.25 n = 3; l = 2; m_l = –2, –1, 0, +1, +2 (any one value)

2.26 (i) 29 protons

2.27 1, 2, 15

2.28 (i)

l	m_l
0	0
1	–1,0,+1
2	–2,–1,0,+1,+2

(ii) l = 2; m_1=–2, –1,0,+1,+2

(iii) 2*s*, 2*p*

2.29 (a) 1*s*, (b) 3*p*, (c) 4*d* and (d) 4*f*

2.30 (a), (c) and (e) are not possible

2.31 (a) 16 electrons (b) 2 electrons

2.33 *n* = 2 to n = 1

2.34 8.72 10^{-18}J

2.35 1.33 10^{9}

2.36 6 nm

2.37 (a) 1.3 10^{4} pm (b) 1.23 10^{6}

2.38 1563

2.39 8

2.40 More number of K–particles will pass as the nucleus of the lighter atoms is small, smaller number of K–particles will be deflected as a number of positve charges is less than on the lighter nuclei.

2.41 For a given element the number of prontons is the same for the isotopes, whereas the mass number can be different for the given atomic number.

2.42 $^{81}_{35}Br$

2.43 $^{37}_{17}Cl^{-1}$

2.44 $^{56}_{26}Fe^{3+}$

2.45 Cosmic rays < X–rays < amber colour < microwave < FM

2.46 3.3 10^{7} J

2.47 (a) 4.87 10^{14} s^{-1} (b) 9.0 10^{9} m (c) 32.27 10^{-20} J
(d) 6.2 10^{18}

2.48 10

2.49 8.828 10^{-10} J

2.50 3.46 10^{-22} J

2.51 (a) 652 nm (b) 4.598 10^{14} s^{-1}
(c) 3.97 10^{-13} J, 9.33 10^{8} ms^{-1}

2.53 4.3 eV

2.54 7.6 10^{3} eV

2.55 infrared, 5

2.56 453 pm

2.57 400 pm

2.58 9.89 ms^{-1}

2.59 332 pm

2.60 1.51 10^{-27} m

2.61 Can not be defined as the actual magnitude is smaller than uncertainity.

2.62 (v) < (ii) = (iv) < (vi) = (iii) < (i)

2.63 4*p*

2.64 (i) 2*s* (ii) 4*d* (iii) 3*p*

2.65 Si

2.66 (a) 3 (b) 2 (c) 6
(d) 4 (e) zero

2.67 16

UNIT 5

5.1 2.5 bar

5.2 0.8 bar

5.4 70 g/mol

5.5 $M_B = 4M_A$

5.6 202.5 mL

5.7 8.314 10^{4} Pa

5.8 1.8 bar

5.9 3g/dm^3

5.10 1247.7 g

5.11 3/5

5.12 50 K

5.13 4.2154 10^{23} electrons

5.14 1.90956 10^6 year
5.15 56.025 bar
5.16 3811.1 kg
5.17 5.05 L
5.18 40 g mol^{-1}
5.19 0.8 bar

UNIT 6

6.1 (ii)
6.2 (iii)
6.3 (ii)
6.4 (iii)
6.5 (i)
6.6 (iv)
6.7 q = + 701 J
w = – 394 J, since work is done by the system
ΔU = 307 J
6.8 – 741.5 kJ
6.9 1.09 kJ
6.10 $\Delta H = -5.65$ kJ mol^{-1}
6.11 – 315 kJ
6.12 $\Delta_r H = -778$ kJ
6.13 – 46.2 kJ mol^{-1}
6.14 – 239 kJ mol^{-1}
6.15 327 kJ mol^{-1}
6.16 $\Delta S > 0$
6.17 200 K
6.18 ΔH is negative (bond energy is released) and ΔS is negative (There is less randomness among the molecules than among the atoms)
6.19 0.164 kJ, the reaction is not spontaneous.
6.20 –55.27 kJ mol^{-1}
6.21 NO(g) is unstable, but NO_2(g) is formed.
6.22 q_{surr} = + 286 kJ mol^{-1}
ΔS_{surr} = 959.73 J K^{-1}

UNIT 7

7.2 12.237 $molL^{-1}$
7.3 2.67 x 10^4
7.5 (i) 4.4 10^{-4} (ii) 1.90
7.6 1.59 10^{-15}
7.8 $[N_2]$ = 0.0482 $molL^{-1}$, $[O_2]$ = 0.0933 $molL^{-1}$, $[N_2O]$ = 6.6 10^{-21} $molL^{-1}$
7.9 0.0355mol of NO and 0.0178mol of Br_2

7.10 7.47 10^{11} M^{-1}

7.11 4.0

7.12 Q_c = 2.97 10^3. No, reaction is not at equilibrium.

7.14 0.44

7.15 0.068 $molL^{-1}$ each of H_2 and I_2

7.16 $[I_2] = [Cl_2]$ = 0.21 M, [ICl] = 0.36 M

7.17 $[C_2H_6]_{eq}$ = 3.62 atm

7.18 (i) $[CH_3COOC_2H_5][H_2O] / [CH_3COOH][C_2H_5OH]$
(ii) 22.9 (iii) value of Q_c is less than K_c therefore equilibrium is not attained.

7.19 0.02$molL^{-1}$ for both.

7.20 $[P_{CO}]$ = 1.739atm, $[P_{CO2}]$ = 0.461atm.

7.21 No, the reaction proceeds to form more products.

7.22 3 10^{-4} $molL^{-1}$

7.23 14.0

7.24 a) – 35.0kJ, b) 1.365 10^6

7.27 $[P_{H2}]_{eq} = [P_{Br2}]_{eq}$ = 2.5 10^{-2}bar, $[P_{HBr}]$ = 10.0 bar

7.30 b) 120.48

7.31 $[H_2]_{eq}$ = 0.96 bar

7.33 2.86 10^{-28} M

7.34 5.85x10^{-2}

7.35 NO_2^-, HCN, ClO_4, HF, H_2O, HCO_3^-, HS^-

7.36 BF_3, H^+, NH_4^+

7.37 F^-, HSO_4^-, CO_3^{2-}

7.38 NH_3, NH_4^+, HCOOH

7.41 2.42

7.42 1.7 x 10^{-4}M

7.43 F^-= 1.5 x 10^{-11}, $HCOO^-$= 5.6 10^{-11}, CN^-= 2.08 x 10^{-6}

7.44 [phenate ion]= 2.2 10^{-6}, pH= 5.65, á= 4.47 10^{-5}. pH of 0.01M sodium phenate solution= 9.30.

7.45 $[HS^-]$= 9.54 x 10^{-5}, in 0.1M HCl $[HS^-]$ = 9.1 10^{-8}M, $[S^{2-}]$= 1.2 10^{-13}M, in 0.1M HCl $[S^{2-}]$= 1.09 10^{-19}M

7.46 $[Ac^-]$= 0.00093, pH= 3.03

7.47 $[A^-]$ = 7.08 x10^{-5}M, K_a= 5.08 10^{-7}, pK_a= 6.29

7.48 a) 2.52 b) 11.70 c) 2.70 d) 11.30

7.49 a) 11.65 b) 12.21 c) 12.57 c) 1.87

7.50 pH = 1.88, pK_a = 2.70

7.51 K_b = 1.6 10^{-6}, pK_b = 5.8

7.52 α = 6.53 10^{-4}, K_a = 2.34 10^{-5}

7.53 a) 0.0018 b) 0.00018

7.54 α = 0.0054

7.55 a) 1.48 10^{-7}M, b) 0.063 c) 4.17 10^{-8}M d) 3.98 10^{-7}

7.56 a) 1.5 10^{-7}M, b) 10^{-5}M, c) 6.31 10^{-5}M d) 6.31 10^{-3}M

7.57 $[K^+] = [OH^-]$ = 0.05M, $[H^+]$ = 2.0 10^{-13}M

7.58 $[Sr^{2+}]$ = 0.1581M, $[OH^-]$ = 0.3162M , pH = 13.50

7.59 α = 1.63 10^{-2}, pH = 3.09. In presence of 0.01M HCl, α = 1.32 10^{-3}

7.60 K_a = 2.09 10^{-4} and degree of ionization = 0.0457

7.61 pH = 7.97. Degree of hydrolysis = 2.36 10^{-5}

7.62 K_b = 1.5 10^{-9}

7.63 NaCl, KBr solutions are neutral, NaCN, $NaNO_2$ and KF solutions are basic and NH_4NO_3 solution is acidic.

7.64 (a) pH of acid solution= 1.94 (b) its salt solution= 2.87

7.65 pH = 6.78

7.66 a) 11.2 b) 7.00 c) 3.00

7.67 Silver chromate S= 0.65 10^{-4}M; Molarity of Ag^+ = 1.30 x 10^{-4}M

Molarity of CrO_4^{2-} = 0.65 10^{-4}M; Barium Chromate S = 1.1 10^{-5}M; Molarity of Ba^{2+} and CrO_4^{2-} each is 1.1 10^{-5}M; Ferric Hydroxide S = 1.39 10^{-10}M;

Molarity of Fe^{3+} = 1.39 10^{-10}M; Molarity of $[OH^-]$ = 4.17 10^{-10}M

Lead Chloride S = 1.59 10^{-2}M; Molarity of Pb^{2+} = 1.59 10^{-2}M

Molarity of Cl^- = 3.18 10^{-2}M; Mercurous Iodide S = 2.24 10^{-10}M;

Molarity of Hg_2^{2+} = 2.24 10^{-10}M and molarity of I^- = 4.48 10^{-10}M

7.68 Silver chromate is more soluble and the ratio of their molarities = 91.9

7.69 No precipitate

7.70 Silver benzoate is 3.317 times more soluble at lower pH

7.71 The highest molarity for the solution is 2.5 10^{-9}M

7.72 2.46 litre of water

7.73 Precipitation will take place in cadmium chloride solution