Answers to Unit 1_2 exercises

Topic 2 Exercise 1

1. a) 0.10 b) 0.078 c) 5500 d) 0.16 e) 0.022
2. a) 3.6 g b) 14.9 g c) 5.6 g d) 39.9 kg e) 6.8 g
3. a) 28 (N_2) b) 40 (Ca) c) 160 (Br_2) d) 28 (N_2) e) 249.6 ($CuSO_4.5H_2O$)
4. a) 1.51×10^{22} b) 3.42×10^{22} c) 1.45×10^{22} d) 2.15×10^{24}
5. a) 11.7 g b) 110 g c) 8.07 mg
6. 1.06 g 7. 729 g 8. 43.3 g, 11.0 g
9. 8.48 g, 9.81 g 10. 1000 tonnes, 226 tonnes
11. a) 45.8% b) 17.0 % c) 87.2 %
12. a) 45.8% b) 67.4% c) 52.2 % so (b) most efficient

Topic 2 Exercise 2

Using molarities and concentrations:

1. 0.025 2. 5.0×10^{-3} 3. 0.079 g 4. 0.993 g
5. 0.043 $moldm^{-3}$ 6. 0.24 $moldm^{-3}$ 7. 30 cm^3
8. 10 cm^3 9. 0.021

Reacting masses and volumes:

1. 0.05 $moldm^{-3}$ 2. 0.092 $moldm^{-3}$ 3. 1.76 gdm^{-3} 4. x = 3
5. 1.04 $moldm^{-3}$ 6. 459 cm^3 7. 85.2, Rb 8. x = 10

Topic 2 Exercise 3

1. 24.4 dm^3 2. 48.7 kPa 3. 57.8 K 4. 35.3 g
5. 31.7 6. a) 149 K, b) 149 K
7. a) 5.80 dm^3, b) 1.45 dm^3, c) 7.25 dm^3 8. 37.2 cm^3
9. a) 51.8 cm^3, b) 43.3 g, c) 3.85 dm^3 10. 0.098 g, 4.04 cm^3
11. a) 280 cm^3, b) 0.22 $moldm^{-3}$

Topic 2 Exercise 4

1. C_3H_6O 2. C_2H_5Br 3. C_4H_8 4. C_8H_{18} 5. C_6H_6 6. Fe_2O_3
7. 16.6 % Si, 83.4 % Cl 8. 327 kg

Topic 2 Exercise 5

A:

1. $NaCl$	2. $AlCl_3$	3. $(NH_4)_2SO_4$	4. $Mg(NO_3)_2$	5. MgO	6. $Cu(OH)_2$
7. Al_2O_3	8. Na_2CO_3	9. Cu_2O	10. CuO	11. $Al_2(SO_4)_3$	12. PbS
13. PbO_2	14. Ca_3N_2				

B:

1. $MgCl_2(aq) + 2AgNO_3(aq) \rightarrow Mg(NO_3)_2(aq) + 2AgCl(s)$
   $Ag^+(aq) + Cl^-(aq) \rightarrow AgCl(s)$
2. $Al_2(SO_4)_3(aq) + 6NaOH(aq) \rightarrow 2Al(OH)_3(s) + 3Na_2SO_4(aq)$
   $Al^{3+}(aq) + 3OH^-(aq) \rightarrow Al(OH)_3(s)$
3. $BaCl_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$
   $Ba^{2+}(aq) + SO_4^{2-}(aq) \rightarrow BaSO_4(s)$
4. $H_2SO_4(aq) + 2NaOH(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$
   $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
5. $CuSO_4(aq) + 2KOH(aq) \rightarrow Cu(OH)_2(s) + K_2SO_4(aq)$
   $Cu^{2+}(aq) + 2OH^-(aq) \rightarrow Cu(OH)_2(s)$
6. $Pb(NO_3)_2(aq) + 2HCl(aq) \rightarrow PbCl_2(s) + 2HNO_3(aq)$
   $Pb^{2+}(aq) + 2Cl^-(aq) \rightarrow PbCl_2(s)$
7. $CaCl_2(aq) + H_2SO_4(aq) \rightarrow CaSO_4(s) + 2HCl(aq)$
   $Ca^{2+}(aq) + SO_4^{2-}(aq) \rightarrow CaSO_4(s)$
8. $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + CO_2(g) + H_2O(l)$
   $CaCO_3(s) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + CO_2(g) + H_2O(l)$
9. $H_2SO_4(aq) + Na_2CO_3(aq) \rightarrow Na_2SO_4(aq) + CO_2(g) + H_2O(l)$
   $2H^+(aq) + CO_3^{2-}(aq) \rightarrow CO_2(g) + H_2O(l)$
10. $CaCl_2(aq) + Na_2CO_3(aq) \rightarrow 2NaCl(aq) + CaCO_3(s)$
    $Ca^{2+}(aq) + CO_3^{2-}(aq) \rightarrow CaCO_3(s)$
11. $NH_3(g) + HNO_3(aq) \rightarrow NH_4NO_3(aq)$
    $NH_3(g) + H^+(aq) \rightarrow NH_4^+(aq)$

Topic 2 Exercise 6

1. n = 2	2. x = 10	3. 1.80 $moldm^{-3}$, 108 gdm^{-3}	4.73.9 %	5. 57.2 %
6. 66.3 %	7. x = 7			

1. Moles of NaOH = 0.0025
   So Moles of succinic acid = 0.00125 (in 18.3 cm^3)
   So Moles of succinic acid = 0.0170 in 250 cm^3
   So Mr of succinic acid = 118
   So mf = $C_4H_6O_4$ and n = 2

2. Moles of HCl = 0.00245
   So Moles of Na_2CO_3 = 0.001225 (in 25.0 cm^3)
   So Moles of Na_2CO_3 = 0.01225 in 250 cm^3
   So Mr of $Na_2CO_3.xH_2O$ = 286

So x = 10

3. Moles of NaOH = 0.0025
So Moles of CH_3COOH = 0.0025 (in 13.9 cm^3)
So Moles of CH_3COOH = 0.0450 in 250 cm^3
So molarity of diluted CH_3COOH = 0.180 $moldm^{-3}$
So molarity of original CH_3COOH = 1.80 $moldm^{-3}$ = 180 gdm^{-3}

4. Moles of NaOH = 0.0025
So Moles of ethanedioic acid = 0.00125 (in 21.3 cm^3)
So Moles of ethanedioic acid = 0.0147 in 250 cm^3
So mass of pure $H_2C_2O_4.2H_2O$ = 1.70 g
So % purity = 73.9%

5. Moles of NaOH = 0.0025
So Moles of $NaHSO_4$ = 0.0025 (in 23.1 cm^3)
So Moles of $NaHSO_4$ = 0.0271 in 250 cm^3
So mass of pure $NaHSO_4$ = 3.24 g
So % purity = 57.2%

6. Moles of NaOH = 0.00187
So Moles of HCl = 0.00187 (in 25.0 cm^3)
So Moles of HCl = 0.0187 in 250 cm^3
So original moles of $SiCl_4$ = 0.00468
So mass of pure $NaHSO_4$ = 0.795 g
So % purity = 66.3%

7. Moles of $ZnSO_4$ = 0.0458
So moles of $ZnSO_4.xH_2O$ = 0.0458
So mr of $ZnSO_4.xH_2O$ = 288
So x = 7