Stage 2 Chem Analytical Techniques *Assignment 2 SOLUTIONS*

1. (a)
   (i) volumetric pipette
   (ii) volumetric burette

   NOTE 3 marks not written on sheet are for sig figs

   (b) a solution of known concentration
   (c) the first permanent colour change (in this case from yellow to orange)
   (d) 23.9 , First titre ignored as it is not concordant (it does not agree closely enough with the others)
   (e) $V_{HCl} = 0.0239$ L $C_{HCl} = 0.0934$ mol L^{-1} $\therefore n_{HCl} = 0.00223$ mol
   $V_{Ca(OH)2} = 0.0200$ L $C_{Ca(OH)2} = ?$
   Half as much $Ca(OH)_2$ as HCl according to equation, so $n_{Ca(OH)2} = 0.00112$ mol

$$C_{Ca(OH)_2} = \frac{n_{Ca(OH)_2}}{V_{Ca(OH)_2}} = \frac{0.00112}{0.0200} = 0.0558 \text{ mol L}^{-1}$$

2. (a) Dectuple the volume, i.e. add nine times the original volume of water.
   (b)
   (i) $V_{HCl} = 0.0212$ L $C_{HCl} = 0.1015$ mol L^{-1} $\therefore n_{HCl} = 0.00215$ mol
   $V_{NH3} = 0.0200$ L $C_{NH3} = ?$
   Same no. moles NH_3 as HCl according to equation, so $n_{NH3} = 0.00215$ mol

$$C_{NH_3} = \frac{n_{NH_3}}{V_{NH_3}} = \frac{0.00215}{0.0200} = 0.108 \text{ mol L}^{-1}$$

   (ii) 1.08 mol L^{-1}
   (iii) M = 17.03 g mol^{-1} $\therefore$ C = 18.4 g L^{-1}
   (c) C = 1.84% w/v

3. (a)
   (i) volumetric pipette
   (ii) volumetric burette
   (b) First permanent pink colour (from colourless)
   (c) An acid, so that hydrogen ions are present for the correct reaction to occur.
   (d) 24.6 mL
   (e) $V_{MnO4^-} = 0.0246$ L $C_{MnO4^-} = 0.200$ mol L^{-1} $\therefore n_{MnO4^-} = 0.00492$ mol
   $V_{H2O2} = 0.0200$ L $C_{H2O2} = ?$
   5/2 times moles H_2O_2 compared to MnO_4^- according to equation, so $n_{H2O2} = 0.0123$ mol

$$C_{H_2O_2} = \frac{n_{H_2O_2}}{V_{H_2O_2}} = \frac{0.0123}{0.0200} = 0.615 \text{ mol L}^{-1}$$

4.
   (a) 0.00141 mol
   (b) Mole ratio 1:1 therefore 0.00141 mol
   (c) x4 (since 100/25 = 4) = 0.00564 mol (0.00282 mol per tablet)
   (d) $m = nM = 0.00282 \times 176.1 = 0.497$ g

   Total /36

   +3 for sig fig use

   Therefore /39

5.
   (a) (i) Distilled water
   (ii) Sodium thiosulfate solution
   (b) 0.200 x 0.0303 = 0.00606 mol
   (c) 1 : 2
   (d) 0.00303 mol
   (e) 0.00375 – 0.00303 = 0.000720 mol
   (f) 0.000720 mol