Answers to Section Review pg 404

Acid + base → salt + water

2. (a) $KOH_{(aq)} + HNO_{3(aq)} \rightarrow KNO_{3(aq)} + H_2O_{(l)}$
   (b) $2HBr_{(aq)} + Ca(OH)_{2(aq)} \rightarrow CaBr_{2(aq)} + 2H_2O_{(l)}$
   (c) $H_3PO_{4(aq)} + 3NaOH_{(aq)} \rightarrow Na_3PO_{4(aq)} + 3H_2O_{(l)}$
   (d) $2HCl_{(aq)} + Mg(OH)_{2(aq)} \rightarrow MgCl_{2(aq)} + 2H_2O_{(l)}$

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3. Equivalence point: point in a titration when the number of moles in the standard solution is stoichiometrically equal to the number of moles in the original solution. End-point: point in a titration when the indicator changes colour. End-point is visual, macroscopic; equivalence point is ionic, microscopic. End-point may be incorrectly read before or after the equivalence point and this reality introduces error into any careless titration. This is why it is important to decide on a standard colour before beginning.

4. $H_2SO_{4(aq)} + 2NH_4OH_{(aq)} \rightarrow (NH_4)_2SO_{4(aq)} + 2H_2O_{(l)}$
   Amount of $NH_4OH_{(aq)}$ (in mol) added = 0.116 mol/L × 0.0328 L
   $= 3.80 \times 10^{-3}$ mol
   H_2SO_4 reacts with NH_4OH in a 1 : 2 ratio so there must be 1.90×10^{-3} mol of H_2SO_4.
   $[H_2SO_{4(aq)}] = \frac{1.90 \times 10^{-3} \text{ mol}}{0.025 \text{ L}} = 7.6 \times 10^{-2}$ mol/L

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5. $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$
   Amount of HCl (in mol) added = 0.235 mol/L × 0.01000 L
   $= 2.35 \times 10^{-3}$ mol
   HCl and NaOH react in a 1 : 1 ratio so there must be 2.35×10^{-3} mol of NaOH.
   $[NaOH] = \frac{2.35 \times 10^{-3} \text{ mol}}{2.202 \times 10^{-2} \text{ L}} = 0.107$ mol/L

F = 23.08
I = 1.06
22.02 mL

6. Liquid in Erlenmeyer flask is usually a standard solution (known concentration) of known volume (25.0 mL) from a pipette, so it is not necessary to dry the flask.

7. (i) Wash hands immediately with water. Apply baking soda to affected area an thoroughly with water.
   (ii) Remove lab coat and rinse in water. Add washing soda to the rinse water.
   (iii) Pour baking soda or dilute solution of a strong base on lab bench. Wipe thoroughly. Rinse with water.

1. Acid + Base → Salt + water (1)

2. (4) see above

5. $HCl_{(aq)} + NaOH_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)}$ (1)

(1) $0.01000\,L \times \frac{0.235 \text{ mol HCl}}{1\,L} \times \frac{1 \text{ mol NaOH}}{1 \text{ mol HCl}} = 2.35 \times 10^{-3}$ mol NaOH

$[NaOH] = \frac{2.35 \times 10^{-3} \text{ mol NaOH}}{(23.08 - 1.06 \text{ mL}) = 0.02202 \text{ L}} \Rightarrow 0.107$ M NaOH

(1)