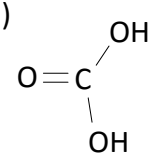
Test - Acids and Bases – Answers

1.
   (a) $H_2SO_4 + 2KOH \rightarrow K_2SO_4 + 2H_2O$
   (b) $Fe(HCO_3)_2 + 2HCl \rightarrow FeCl_2 + 2H_2O + 2CO_2$
   (c) $CaO + H_2O \rightarrow Ca(OH)_2$
   (d) $P_4O_{10} + 6H_2O \rightarrow 4H_3PO_4$

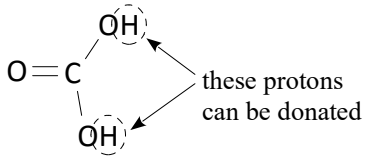
2.
   (a) ammonia (NH_3)
   (b) ammonium ions (NH_4^+)
   (c) exothermic

3. Since citric acid is a weak acid, it only partially ionises in solution, whereas hydrochloric acid is a strong acid so it fully ionises. Therefore the solution of citric acid will have a much lower hydrogen ion concentration.

4.
   (a) oxyacids
   (b)



   (c)



   (d) diprotic
   (e) approximately 5.6

5.
   (a) $\left[H^+\right] = 10^{-pH}$
   $= 10^{-5} = 1 \times 10^{-5}$ mol L^{-1}
   (b) Basic

6. *[this is not the only correct equation/answer to this question]*
   Acid rain is formed when strongly acidic oxides such as NO_2 react with rain water.
   $NO_2 + H_2O \rightarrow HNO_3 + HNO_2$
   These strong acids ionise, increasing the concentration H^+ and decreasing the pH of rain below 5.6.
   Acid rain can wash ions from soil into the water which may harm plants and animals.

7.

(a) $M_{Al} = 26.98$ g/mol

$$n_{Al} = \frac{m_{Al}}{M_{Al}} = \frac{0.704}{26.98} = 0.0261 \text{ mol}$$

(b) $$\frac{n(Al)}{n(H_2SO_4)} = \frac{2}{3}$$

(c) $$n(H_2SO_4) = \frac{3}{2} \times n(Al) = \frac{3}{2} \times 0.0261 = 0.0392 \text{ mol}$$

(d) $$C_{H_2SO_4} = \frac{n_{H_2SO_4}}{V_{H_2SO_4}} = \frac{0.0392}{0.0140} = 2.80 \text{ mol/L}$$

(e) $M_{H_2SO_4} = 98.076$ g/mol

$\therefore 2.80 \times 98.076 = 274$ g/L

$\therefore 274 \div 10 = 27.4$ g/100mL $= 27.4$ %w/v

BONUS QUESTION

$$n_{Mg} = \frac{m_{Mg}}{M_{Mg}} = \frac{0.912}{24.31} = 0.0375 \text{ mol}$$

$\frac{n_{HCl}}{n_{Mg}}$ is $\frac{2}{1}$

$$\therefore n_{HCl} = n_{Mg} \times \frac{2}{1} = 0.0375 \times \frac{2}{1} = 0.0750 \text{ mol}$$

$$V_{HCl} = \frac{n_{HCl}}{C_{HCl}} = \frac{0.0750}{0.176} = 0.426 \text{ L}$$