Marking scheme for Core Worksheet – Chapter 8

1 **a** $Zn + 2HCl \rightarrow ZnCl_2 + H_2$ [1]

b $Na_2O + 2HNO_3 \rightarrow 2NaNO_3 + H_2O$ [1]

c $NH_3 + H_2SO_4 \rightarrow (NH_4)_2SO_4$ [1]

d $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$ [1]

2 1 mark for the left-hand side, 1 mark for right-hand side and 1 mark for identifying conjugate pairs in some way

a $\underset{\text{base 1}}{NH_3(aq)} + \underset{\text{acid 2}}{H_2O(l)} \rightarrow \underset{\text{acid 1}}{NH_4^+(aq)} + \underset{\text{base 2}}{OH^-(aq)}$ [2] [1]

b $\underset{\text{acid 1}}{CH_3COOH(aq)} + \underset{\text{base 2}}{H_2O(l)} \rightarrow \underset{\text{base 1}}{CH_3COO^-(aq)} + \underset{\text{acid 2}}{H_3O^+(aq)}$ [2] [1]

c $\underset{\text{acid 1}}{CH_3COOH(aq)} + \underset{\text{base 2}}{NH_3(aq)} \rightarrow \underset{\text{base 1}}{CH_3COO^-(aq)} + \underset{\text{acid 2}}{NH_4^+(aq)}$ [2] [1]

d $\underset{\text{acid 1}}{HSO_4^-(aq)} + \underset{\text{base 2}}{H_2O(l)} \rightarrow \underset{\text{base 1}}{SO_4^{2-}(aq)} + \underset{\text{acid 2}}{H_3O^+(aq)}$ [2] [1]

3 A Lewis acid is an electron pair acceptor. [1]

A Lewis base is an electron pair donor. [1]

NH_3 is a Lewis base as it has a lone pair. [1]

BF_3 is a Lewis acid as it has space in the outer shell of B to accept a pair of electrons. [1]

4 **a** hydrochloric acid is a strong acid and dissociates completely in aqueous solution [1]

ethanoic acid is a weak acid and dissociates partially in aqueous solution [1]

b measure electrical conductivity [1]

ethanoic acid has lower conductivity [1]

measure pH [1]

ethanoic acid has higher pH [1]

add Mg/$CaCO_3$ etc. [1]

hydrochloric acid reacts more violently [1]

5 **a** $pH = -\log_{10}[H^+(aq)]$ [1]

b higher in pH = 2 [1]

10^6 times higher [1]

c solution A: pH = 4 [1]

solution B: pH = 5 [1]

solution C: pH approaches 7 [1]

6 **a** $HCOOH(aq) + H_2O(l) \rightarrow HCOO^-(l) + H_3O^+(aq)$

or $HCOOH(aq) \rightarrow HCOO^-(l) + H^+(aq)$ [1]

b weak [1]

c $2HCOOH(aq) + Mg(s) \rightarrow (HCOO)_2Mg(aq) + H_2(g)$ [1]

d more will dissociate [1]

Le Chatelier's principle: H^+ removed from equilibrium in part a by reaction with OH^- [1]

position of equilibrium shifts to right to replace the H^+ [1]