

Name of the Student: _____

Max. Marks : 15 Marks

Time : 15 Minutes

Mark Schemes

Q1.

(a) completely dissociates/ionises (to form H^+ ions) 1

(b) **M1** moles $HCl = 1.035 \times 10^{-3}$ and moles $Ba(OH)_2 = 3.75 \times 10^{-3}$
If M1 incorrect, lose M1 and M6 1

M2 moles $OH^- = 2 \times (3.75 \times 10^{-3} = 7.50 \times 10^{-3})$
If M2 not x2, lose M2 and M6 1

M3 XS n $OH^- = 7.50 \times 10^{-3} - 1.035 \times 10^{-3} = 6.465 \times 10^{-3}$ mol in 35.35 cm^3
If no subtraction for M3, lose M3 and M6 1

M4 $[OH] = 6.465 \times 10^{-3} / 35.35 \times 10^{-3} = 0.182885 \text{ mol dm}^{-3}$
 $= M3/35.35 \times 10^{-3}$
If M4 not /35.35 $\times 10^{-3}$, lose M4 and M6
However, if divided by 35.35 only lose M4 and allow M6 (ecf = 10.09) 1

M5 $[H^+] = K_w/[OH^-] = 1.47 \times 10^{-14} / 0.182885 = 8.0378 \times 10^{-14} \text{ mol dm}^{-3}$
 $= 1.47 \times 10^{-14} / M4$
If incorrect rearrangement or wrong equation, lose M5 and M6
If $K_w = 1.00 \times 10^{-14}$ used only lose M5 and allow M6 (ecf = 13.26) 1

M6 pH = 13.09 to 13.10
Must be 2dp 1

Alternative MS to get M2:

Starting amounts are 1.035×10^{-3} mol HCl and 3.75×10^{-3} mol $Ba(OH)_2$ M1

So the HCl will react with 5.175×10^{-4} mol of the $Ba(OH)_2$ leaving an excess of 3.2325×10^{-3} mol of $Ba(OH)_2$ (as alternative M2)

So n $OH^- = 2 \times 3.2325 \times 10^{-3} = 6.465 \times 10^{-3}$ mol M3
Credit other methods eg limiting reagent method since HCl limiting reagent

(c) $[H^+] = [OH^-]$

1

(d) SO_2

1

(e) $K_a = \frac{[\text{CH}_3\text{COO}^-][\text{H}^+]}{[\text{CH}_3\text{COOH}]}$

1

(f) **M1** moles HCl added = 0.01 mol and moles CH_3COOH = 0.035 mol

1

M2 moles CH_3COO^- = 0.025 – 0.01 (= 0.015)

M2 mol CH_3COO^- = 0.025 - M1(HCl)

1

M3 moles CH_3COOH = 0.035 + 0.01 (= 0.045)

M3 mol CH_3COOH = M1(CH_3COOH) + M1(HCl)

1

M4 $[\text{H}^+] = 1.76 \times 10^{-5} \times \frac{\text{M3 (l V)}}{\text{M2 (l V)}} (= 5.28 \times 10^{-5})$

M4 is conditional on an attempt at an addition/subtraction in M2 OR M3

1

M5 pH = 4.28

M5 must be 2dp

If used 0.07 mol for CH_3COOH can score M2, M3 and M4 (pH = 4.03)

1

[15]