Practice Question Set For A-Level
Subject : Chemistry
Paper-1 Topic: Physical 1_Acids And Bases

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Name of the Student:_____
Max. Marks : 26 Marks **Time : 26 Minutes**

Mark Schemes

Q1.

(a) Over time / after storage meter does not give accurate readings

Do not allow 'to get an accurate reading' or 'reading drifts' on its own.

Allow 'temperature variations affect readings'.

1

(b) Any **five** from:

Ignore references to the use of the pipette, the filling of the burette and the calibration of the pH meter.

- Measure pH (of the acid)
- Add alkali in known small portions

  Allow 1 – 2cm^3.
- Stir mixture
- Measure pH (after each addition)
- Repeat until alkali in excess

  Allow 27 – 50cm^3.
- Add in smaller increments near endpoint

  Allow 0.1 – 0.5cm^3.

  To score full marks, the sequence must follow a logical order.

5 max

[6]

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Q2.

(a) (i) $[H^+][OH^-]$ ***OR*** $[H_3O^+][OH^-]$

Ignore (aq)

Must have [ ] not ( )

1

(ii) $\sqrt{}3.46 \times 10^{-14}$ $(= 1.86 \times 10^{-7})$

If no square root, CE=0

1

pH = 6.73

Must be 2dp

1

(iii) $[H^+] = 10^{-11.36}$ $(= 4.365 \times 10^{-12}$ OR $4.37 \times 10^{-12})$

Mark for working

1

Kw = $[4.365 \times 10^{-12}$ ***OR*** $4.37 \times 10^{-12} \times 0.047] = 2.05 \times 10^{-13}$

Allow 2.05×10^{-13} – 2.1×10^{-13}

Mark for answer

Ignore units

1

(b) (i) $HCOOH \rightleftharpoons HCOO^- + H^+$

Must have $\rightleftharpoons$ *but ignore brackets.*

OR $HCOOH + H_2O \rightleftharpoons HCOO^- + H_3O^+$

Allow HCO_2^- or $CHOO^-$ ie minus must be on oxygen, so penalise $COOH^-$

1

(ii) $K_a = \frac{[H^+][HCOO^-]}{HCOOH}$ ***OR*** $\frac{[H_3O^+][HCOO^-]}{HCOOH}$

Must have all brackets but allow ( )

Must be HCOOH etc.

Allow ecf in formulae from (b)(i)

1

(iii) M1

$K_a = \frac{[H^+]^2}{[HCOOH]}$ $\left([H^+]^2 = 1.78 \times 10^{-4} \times 0.056 = 9.97 \times 10^{-6}\right)$

Allow HA or HX etc.

Allow $[H^+] = \sqrt{}(Ka \times [HA])$ for M1

1

M2 $[H^+] = 3.16 \times 10^{-3}$

Mark for answer

1

M3 pH = 2.50 allow more than 2 dp but not fewer

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Allow correct pH from their wrong *[H^+]* ***here only*** *If square root shown but not taken, pH = 5.00 can score max 2 for M1 and M3*

1

(iv) M1 Decrease **Mark M1 independently**

1

M2 Eqm shifts / moves to RHS ***OR*** more H^+ ***OR*** K_a increases ***OR*** more dissociation

1

M3 To reduce temperature or oppose increase / change in temperature

Only award M3 following correct M2

1

(c) (i) M1 $[H^+] = \dfrac{Ka \times [HX]}{[X^-]}$ ***OR*** $pH = pK_a - \log \dfrac{[HX]}{[X^-]}$

If [HX]/[X^-] upside down, no marks

1

M2 $\dfrac{1.78 \times 10^{-4} \times 2.35 \times 10^{-2}}{1.84 \times 10^{-2}}$ ***OR*** $pH = 3.75 - \log \dfrac{2.35 \times 10^{-2}}{1.84 \times 10^{-2}}$

(= 2.27×10^{-4})

1

M3 pH = 3.64 allow more than 2 dp but not fewer

pH calc NOT allowed from their wrong [H^+] here

1

(ii) M1 Mol H^+ added = 5.00×10^{-4}

Mark on from AE in moles of HCl (eg 5×10^{-3} gives pH = 3.42 scores 3)

1

M2 Mol HCOOH = 2.40×10^{-2} **and** Mol $HCOO^-$ = 1.79×10^{-2}

If either wrong no further marks except AE (−1) OR if ECF in mol acid and / or mol salt from (c)(i), can score all 4

1

M3 $[H^+] \left(= \dfrac{Ka \times [XH]}{[X^-]}\right) = \dfrac{1.78 \times 10^{-4} \times 2.40 \times 10^{-2}}{1.79 \times 10^{-2}} \left(= 2.39 \times 10^{-4}\right)$

If [HX]/[X^-] upside down here after correct expression in (c)(i), no further marks

OR $pH = 3.75 - \log \dfrac{2.40 \times 10^{-2}}{1.79 \times 10^{-2}}$

If [HX]/[X^-] upside down here and is repeat error from (c)(i), max 3 (pH = 3.88 after 3.86 in (c)(i))

1

M4 pH = 3.62 allow more than 2 dp but not fewer

pH calc NOT allowed from their wrong [H^+] here

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1

[20]

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