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) (i) $-\log[H^+]$
or $\log 1/[H^+]$
penalise ( )
1

(ii) $[H^+] = 0.56$
mark for the answer; allow 2dp or more
1

$[H_2SO_4] = ½ \times 0.56 = 0.28$
1

(b) (i) $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$

OR

$CH_3COOH + OH^- \rightarrow CH_3COO^- + H_2O$
Allow CH_3CO_2H etc
1

(ii) mol acid = $(25.0 \times 10^{-3}) \times 0.41 = 1.025 \times 10^{-2}$ or 1.03×10^{-2}
1

$[NaOH] = 1.025 \times 10^{-2}/22.6 \times 10^{-3} = 0.45(4)$
mark for answer
if not 0.454 look back for error
1

OR

$[NaOH] = 1.03 \times 10^{-2}/22.6 \times 10^{-3} = 0.456$ or 0.46

(iii) cresol purple
1

(iv) NaOH reacts with <u>carbon dioxide</u> (in the air)
1

(c) (i) $K_a = \dfrac{[H^+][CH_3COO^-]}{[CH_3COOH]}$

allow molecular formulae or minor slip in formulae
penalise ( )
allow H_3O^+

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not allow HA etc

1

(ii) $K_a = \frac{[H^+]^2}{[CH_3COOH]}$ or with numbers

1

allow HA etc here
This can be scored in part (c)(i) but doesn't score there.

$[H^+] = (\sqrt{(1.74 \times 10^{-5} \times 0.410)} = \sqrt{(7.13 \times 10^{-6})}) = 2.67 \times 10^{-3}$

1

mark for 2.67×10^{-3} or 2.7×10^{-3} either gives 2.57

pH = 2.57 can give three ticks here for (c)(ii)
penalise decimal places < 2 >

1

pH mark conseq on their $[H^+]$
so 5.15 gets 2 marks where square root not taken

(iii) **M1** mol OH^- = $(10.0 \times 10^{-3}) \times 0.10 = 1.0 \times 10^{-3}$
If no subtraction or other wrong chemistry the max score is 3 for M1, M2 and M4

1

M2 orig mol HA = $(25.0 \times 10^{-3}) \times 0.41 = 0.01025$

1

or 1.025×10^{-2} or 1.03×10^{-2}

M3 mol HA in buffer = orig mol HA – mol OH^-

1

= 0.00925 or 0.0093
If A^- is wrong, max 3 for M1, M2 and M3 or use of
pH = pKa – log [HA]/[A^-]

M4 mol A^- in buffer = mol OH^- = 1.0×10^{-3}
Mark is for insertion of correct numbers in correct expression for $[H^+]$

1

M5 $[H^+] = \left(\frac{K_a \times [CH_3COOH]}{[CH_3COO^-]} = \right)$

1

$\frac{(1.74 \times 10^{-5})(0.00925)}{0.0010}$ or $\frac{(1.74 \times 10^{-5})(0.00930)}{0.0010}$

(= 1.61×10^{-4} or 1.62×10^{-4})

M6 pH = 3.79 can give six ticks for 3.79
if [HA]/[A^-] upside down lose M5 & M6
If wrong method e.g. $[H^+]^2$/[HA] max 3 for M1, M2 and M3
Some may calculate concentrations
[HA] = 0.264 and [A^-] = 0.0286 and rounding this to 0.029 gives pH = 3.80 (which is OK)

NB Unlike (c)(ii), this pH mark is NOT awarded conseq to their

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$[H^+]$ unless following AE

BEWARE: using 0.01025 wrongly instead of 0.00925 gives pH = 3.75 (this gets 3 for M1, M2 & M4)

1

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Q2.

(a) (i) **B** 1

C

1

A

1

(ii) cresolphthalein or thymolphthalein

1

(b) $pH = -\log[H^+]$

1

$K_a = \frac{[H^+]^2}{[CH_3COOH]}$ or $[H^+] = [A^-]$

1

$[H^+] = \sqrt{1.74 \times 10^{-5} \times 0.15}$ (or 1.62×10^{-3})

1

pH = 2.79 (penalise 1 dp or more than 2dp once in the qu)

1

[8]

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