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 : 20 Marks **Time : 20 Minutes**

Mark Schemes

Q1.

(a) $CH_3COOH + H_2O \rightleftharpoons CH_3COO^- + H_3O^+$

OR

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

Must show $\rightleftharpoons$
Allow CH_3CO_2H, $CH_3CO_2^-$
Ignore state symbols

1

(b) ($CH_3COOH + \underline{HNO_3} \longrightarrow CH_3COOH_2^+ + NO_3^-$)

IGNORE $\rightleftharpoons$
Allow CH_3CO_2H, $CH_3CO_2H_2^+$, $CH_3C^+(OH)_2$

1

(c) (i) (new $[HNO_3] = [H^+] = \frac{100}{150} \times 0.0125$)

M1 $[H^+] = 8.3(3) \times 10^{-3}$ (mol dm^{-3})
OR
new$[HNO_3]$ = $\frac{\text{mol } HNO_3}{\text{total vol}} = \frac{1.25 \times 10^{-3}}{150 \times 10^{-3}}$

1

M2 pH = − log M1 OR 2.08
Must be 2dp
Allow correct pH conseq to their $[H^+]$ *concentration*

1

(ii) M1 mol NaOH (= $50 \times 10^{-3} \times 0.0108$) = 5.40×10^{-4}

1

M2 Subtraction of M1 from moles of HNO_3 (1.25×10^{-3} or conseq from 1c(i))

Excess mol $H^+ = 7.10 \times 10^{-4}$
M2 allow ecf for subtraction of mol
If no subtraction, no further marks

1

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M3 $[H^+] = \frac{M2}{\ldots}$ OR $\frac{7.10 \times 10^{-4}}{150 \times 10^{-3}} = 4.73 \times 10^{-3}$

M3 if no use of volume, no further marks (pH=3.15)

If incorrect volume used, can score M4

1

M4 pH = -log M3 OR 2.32

M4 Allow 2.33 Must be 2 dp

1

(d) (i) M1 $K_a = \frac{[H^+][CH_3COO^-]}{[CH_3COOH]}$

Penalise ( ) once here Not [H+][A-] / [HA]

If K_a expression wrong – Allow correct pH conseq to their $[H^+]$ concentration M4 only

1

M2 $K_a = \frac{[H^+]^2}{[CH_3COOH]}$ or with numbers or with HA

1

M3 $[H^+] = [\sqrt{(1.74 \times 10^{-5} \times 0.0125)}] = 4.66 \times 10^{-4}$

Mark for answer

1

M4 pH = 3.33

Must be 2dp

Allow correct pH conseq to their $[H^+]$ concentration

(pH = 3.83 can score M1, M2 and M4)

1

(ii) Sodium ethanoate

Ignore formula

Allow sodium acetate

1

(iii) M1 $[H^+] = 1.45 \times 10^{-5}$

Accept 1.445×10^{-5} or 1.4×10^{-5}

1

M2 $\frac{[salt]}{[acid]}$ (OR $\frac{[CH_3COO^-]}{[CH_3COOH]} = \frac{Ka}{[H^+]}$)= $\frac{1.74 \times 10^{-5}}{1.45 \times 10^{-5}}$

If M1 incorrect CE=0

Inclusion of 0.0125 in calculation can only score M1

1

M3 1.2(0)

Ignore units

1.4×10^{-5} gives 1.24

1

(e) M1 (Electronegative) chlorine withdraws electrons

Allow Cl has negative inductive effect

1

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M2 Stabilises/reduces charge on COO-

OR weakens O-H bond

OR makes O-H more polar

Ignore chloroethanoic acid dissociates more readily

Mark independently

1

(f) M1 Strong acids (almost) completely dissociated/ionised

OR not an equilibrium

OR equilibrium lies far to the right

Cannot have K_a value for a reaction not in equilibrium scores both marks

1

M2 K_a value for strong acids tends to infinity/is very large
OR can't divide by zero in K_a

1

[20]

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