THE OPEN UNIVERSITY OF SRI LANKA
B. Sc. Degree Programme / Stand alone course – Level 4

CHU 2125/ CHE 4125 – Analytical Chemistry – 2009/2010
Assignment Test I
Answers Guide

1 (a) (i)
Acidic buffer or weak acid / Conjugate Base $H_2PO_4^-$ / HPO_4^{2-}
Basic buffer or weak base / Conjugate Acid NH_4Cl / NH_4OH

(ii)
$pH = pK_a + \log [A^-]/[HA]$

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(iii)
$pH = 3.75 + \log 0.1/0.2$
$= 3.44$

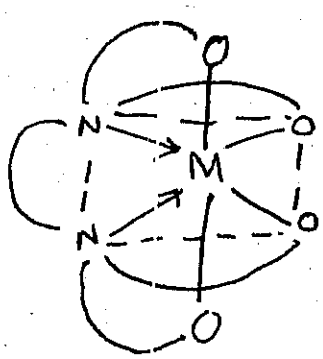
$HCOOH + NaOH \rightarrow HCOO^-Na^+ + H_2O$
0.2 0.01 0.01 -

$pH = 3.75 + \log 0.11/0.19$
$pH = 3.51$
$\Delta pH = 3.51 - 3.44 = (0.06 \approx 0.07)$

(b) (i)
1. The reaction should be rapid
2. The reaction should be stoicheometric
3. The Gibbs free energy of the reaction should be a larger negative value (the reaction should be feasible)

(ii)
The analyte is first replaced by an equivalent amount of another substance which is then determined by titration. For example ferric ions were treated with an excess KI to generate I_2, and then titrated with $Na_2S_2O_3$

(c) (i)



(b) (i)

1. pH
2. Temperature
3. Complexing Agents
4. Other side reactions possible in that medium
5. The size of the particles

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(ii)

There are <u>two</u> methods of contamination

Co precipitation, is the precipitation of an impurity along with the desired precipitate and **Post precipitation**, is the precipitation of an impurity from a super saturated solution on to the surface of an already present precipitate.

Coprecipitation further is classified in to three types

Occlusion- Occurs when an adsorbed impurity gets physically trapped inside as it grows

Adsorption – Adsorbate is an impurity that is weakly bound to the surface of the precipitate

Remedies –

1. Digestion, waiting for the precipitate to equilibrate and form larger purer particles.
2. Redissolve the sample and precipitate again.

3.(a) (i)

$Fe^{2+} \leftrightarrow Fe^{3+} + e$

$Ce^{4+} + e \leftrightarrow Ce^{3+}$

(ii)

$E_{CELL} = E^0 - RT/1.F \ln [Fe^{2+}]/[Fe^{3+}]$ or $E_{CELL} = E^0 - RT/1.F \ln [Ce^{3+}]/[Ce^{4+}]$

$$K = \frac{[Fe^{3+}][Ce^{3+}]}{[Fe^{2+}][Ce^{4+}]}$$

(iii)

(I) 0.1M

(II) (i)

1st half equivalence point :

$E_{CELL} = E^0 - RT/1.F \ln [Fe^{2+}]/[Fe^{3+}]$

$[Fe^{2+}] = [Fe^{3+}]$

$E_{CELL} = E^0_{CELL} = + 0.767$ v

(ii)

$E_{CELL} = E^0 - RT/1.F \ln [Ce^{3+}]/[Ce^{4+}]$

$[Ce^{4+}] = [Ce^{3+}]$

$E_{CELL} = E^0_{CELL} = + 1.70$ v

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(iii)

$2\ E_{CELL} = E^0_{Fe3+/Fe2+} + E^0_{Ce4+/Ce3+} - RT/nF \ln [Fe^{2+}][Ce^{3+}]/[Fe^{3+}][Ce^{4+}]$

$[Fe^{3+}] = [Ce^{3+}]$

$[Fe^{2+}] = [Ce^{4+}]$

$E_{CELL} = (0.767 + 1.70) / 2$

$E_{CELL} = 1.234$ V

Note: Marks were awarded for alternate methods as well.

(iv)

$E^0_{CELL} = E^0_C - E^0_A$

$= 1.70 - 0.767$

$= + 0.933$ V

(v)

1. Self Indicator
2. Potentiometric Method

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Assignment Test II
Answers

1. 2
2. 2
3. 5
4. 1
5. 1
6. 4
7. 5
8. 5
9. 4
10. 2
11. 2
12. 3
13. 4
14. 5
15. 4
16. 4
17. 2
18. 3
19. 1
20. 2
21. 5
22. 4
23. 4
24. 1
25. 3
26. 3
27. 2
28. 5
29. 2
30. 2