TEE CHEMISTRY

Semester 1 Examination 2004

SOLUTIONS

Part 1

1. c	6. a	11. c	16. a
2. c	7. b	12. b	17. c
3. d	8. c	13. c	18. a
4. a	9. b	14. b	19. c
5. a	10. a	15. b	20. a

Part 2

1 (a)

Equation $OH^-_{(aq)} + H^+_{(aq)} \rightarrow H_2O_{(\ell)}$

Observation Test tube feels warm

(b)

Equation $Cu^{+2}(aq) + 2OH^-(aq) \rightarrow Cu(OH)_2\ (s)$

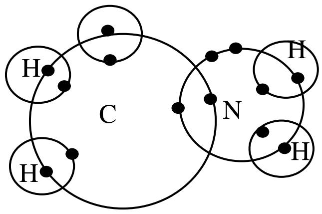
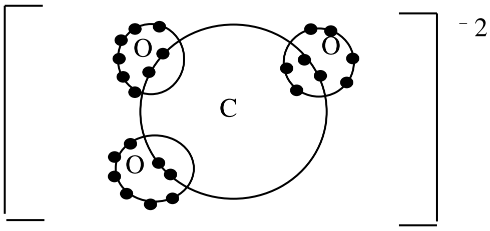
Observation When the colourless solution is added to the pale blue solution a pale blue ppt forms

(c)

Equation $2H_2O_2(\ell) \rightarrow 2H_2O(l) \rightarrow + O_2(g)$

Observation Small colourless bubbles appear on the surface of the black solid

2.

Methanamine, CH_3NH_2 H	Polar of Non Polar?
	**POLAR**
Carbonate ion, CO_3^{2-}	Polar or Non Polar?
	**NON POLAR**

3.

Substance	Electrical conductivity			Solubility in water	Colour of solid	Name of substance
	Solid	Liquid	Water solution			
A	nil	conducts	conducts	soluble	white	Sodium Chloride
B	nil	nil	nil	soluble	white	Sucrose
C	conducts	conducts	—	insoluble	pink	Copper
D	nil	conducts	—	insoluble	white	Aluminium Carbonate

4. (a) $HC\ell O_4 \rightarrow H^+ + C\ell O_4^-$

$[H^+] = 0.05m$

$pH = -\log_{10} 0.05$

$= 1.30$

(b) $Ba(OH)_2 \rightarrow Ba^{+2} + 2OH^-$

$\therefore [H^+] = 2 \times 0.05 = 0.1$

$$[H^+] = \frac{10^{-14}}{10^{-1}} = 1 \times 10^{-13}$$

$pH = -\log_{10}[H^+] = -\log_{10} 1 \times 10^{-13}$

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= 13

5.

SUBSTANCE	STRONG ACID	WEAK ACID	DILUTE ACID	CONCENTRATED ACID
0.05 mol L^{-1} H_2CO_3		✓	✓	
10 mol L^{-1} HCl	✓			✓
10 mol L^{-1} CH_3COOH		✓		✓
1.0 mol L^{-1} H_2SO_4	✓		✓	

6. (a) The amount of CO(g) is **more**

Explanation Rate of reverse reaction decreases (lower concentration of H_2Og) But rate of forward reaction decreases more resulting in less collisions since both H_2 and CO(g) have lower concentration.

(b) The amount of CO(g) is more

Explanation Both reaction rates will decrease but the forward endothermic reaction decreases more.

(c) The amount of CO(g) is the same as before

Explanation The increased surface changes rates forward and back to the same extent. There are no changes in concentration

PART 3

(a) m(ppt) $= \frac{m}{M} = \frac{0.2920}{146.116}$ = 0.001998 moL

$n(Ca^{++}) = n(Ca) = n(ppt)$ = 0.001998 moL

$\therefore$ m(Ca) in 0.4367g sample = n x M

= 0.001998 x 40.08

= <u>0.08 g</u>

$M(CaC_2O_4.H_2O)$	
Ca	40.08
C	24.02
O	64.00
H_2O	18.016
	146.116

$\therefore$ % Ca in sample $= \frac{\text{mass of Ca}}{\text{mass sample}} \times \frac{100}{1}$

$= \frac{0.08}{0.4367} \times \frac{100}{1}$

= <u>18.3%</u>

(b) Total m(ppt) = m(calcium precipitate) + m(other)

This would give % Ca too high

2. (a) $n(CO_2) = \frac{V}{22.41} = \frac{0.8032}{22.41}$ = 0.03584 moL = n(C)

$\therefore$ %C $= \frac{\text{mass(C)}}{3.55} \times \frac{100}{1} = \frac{0.03584 x 12.01}{3.55} \times \frac{100}{1}$ = 12.125%

$n(AgC\ell) = \frac{m}{M} = \frac{12.34}{143.35}$ = 0.08608 moL = $n(C\ell)$

M $AgC\ell$	
Ag	107.9
$C\ell$	35.45
	143.35

$\therefore$ % (O) in samples = 100 – (12.125) + 71.63)

= <u>16.245%</u>

	C	$C\ell$	O
% by mass	12.125	71.63	16.245
Moles	$\frac{12.125}{12.01}$ = 1.01	$\frac{71.63}{35.45}$ = 2.02	$\frac{16.245}{16}$ = 1.02
Simple Ratio	1	2	1

$\therefore$ EF = $C\,C\ell_2O$

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(b) Density $= \frac{m}{v} = 4.42 gL^{-1}$ (STP)

Molar Volume is 22.41 L (STP) so molar

mass is M = density x 22.41

= 99.05 g moL^{-1}

E.F Molar Mass

C = 12.01

$C\ell_2$ = 35.45

= 35.45

O = 16.00

98.91 g moL^{-1}

Which is close to true molar mass (99.05 g moL^{-1})

$\therefore$ EF = True Formulae = C $C\ell_2$O

3.

$OH^- + H^+ \rightarrow H_2O$

$Ba(OH)_2 + H_2C_2O_4 \rightarrow 2H_2O + BaC_2O_4$

1moL 1moL

(a) $n(H_2C_2O_4) = n(Ba(OH)_2) = CxV$
(20mℓ) = 0.103 x 14.3 x 10^{-3}
= $\underline{1.4729 \times 10^{-3}}$ moL

$\therefore n(H_2C_2O_4) = \frac{1000}{20} \times \frac{1.4729x10^{-3}}{1} = \underline{0.07365}$ moL
1000ml and
100ml (original)

So $C(H_2C_2O_4) = \frac{n}{v}$
(original)

$= \frac{0.07365}{10^{-1}} = \underline{0.736M}$

(b) $n(H_2C_2O_4)$ per litre = 0.73645 moL
original
$\therefore$ m $(H_2C_2O_4)$ = nx M

= 0.73645 x 90.036

= $\underline{66.3g}$

4.

(a) $Pb^{+2}_{(aq)} + 2C\ell^{-}_{(aq)} \rightarrow Pb\,C\ell_{2}(s)$

(b) $n(Pb^{+2}) = n\,Pb(NO_3)_2 = CxV = 150 \times 10^{-3} \times 0.2$
$= 30 \times 10^{-3}$ moL
$n(C\ell^{-}) = n(KC\ell) = CxV = 350 \times 10^{-3} \times 0.5$
$= 175 \times 10^{-3}$ moL

From Equn $\dfrac{n(Cl^{-})}{n(Pb^{+2})} = \dfrac{2}{1}$

From Data $\dfrac{n(Cl^{-})}{n(Pb^{+2})} = \dfrac{175}{30} = \dfrac{5.8}{1}$ so we have

excess $C\ell^{-}$ and Pb^{+2} is <u>L.R</u>

From Equn $n(PbC\ell_2) = n(Pb^{+2}) = 30 \times 10^{-3}$ moL

So mass $(PbC\ell_2) = n \times M = 30 \times 10^{-3} \times 278.1$
$=$ <u>8.34 g</u>

(c) The K^{+} and NO_3^{-} remain in soln and the excess $C\ell^{-}$ also
Total volume is 500 ml

So $[K^{+}] = \dfrac{n(K^{+})}{500x10^{-3}} = \dfrac{175x10^{-3}}{500x10^{-3}} =$ <u>0.350 molL⁻¹</u>

$[NO_3^{-}] = \dfrac{n(NO_3^{-})}{500x10^{-3}}\ \dfrac{60x10^{-3}}{500x10^{-3}} =$ <u>0.120 molL⁻¹</u>

$n(C\ell^{-})$ Excess $= n(C\ell^{-})$ Original $-$ $n(C\ell^{-})$ Used
$nC\ell^{-}$ (used) $= 2n(Pb^{+2})$ (used) $= 60 \times 10^{-3}$ moL
$\therefore n(C\ell^{-})$ Excess $= 175 \times 10^{-3} - 60 \times 10^{-3}$
$= 115 \times 10^{-3}$ moLs

$\therefore [C\ell^{-}] = \dfrac{n(excess)}{500x10^{-3}} = \dfrac{115x10^{-3}}{500x10^{-3}} = 0.230\ molL^{-1}$

For answers to the Part 4 please see the section containing Extended Answer Questions