Meridian JC 2012 H2 Chemistry Paper 2 Suggested Answers

1. (ai)

- 1. Using a measuring cylinder, measure 100 cm³ of water and place it in a 250 cm³ beaker.
- 2. Add solid KC/O_3 to water and stir with a glass rod to dissolve the solids.
- 3. Add more solid KC/O₃ to the water until excess solids remains / no more solid dissolves.
- 4. Allow the mixture to stand for a period of time (eg. 30 min) to establish equilibrium.
- 5. Filter the solution to mixture to obtain the saturated solution as a filtrate.

(ii)

- 1. Weigh an empty evaporating basin using a mass balance.
- 2. Using a measuring cylinder, transfer 20 cm³ of the saturated solution from (b)(i) into the weighed evaporating basin. (Any volume from 20 -50 cm³)
- 3. Weigh the evaporating basin and saturated solution.
- 4. Evaporate the water from the solution by placing the evaporating basin on top of a beaker of boiling water.
- 5. Cool and reweigh the evaporating basin.
- 6. Repeat the heating, cooling and weighing until a constant mass is obtained.
- (iii) Mass of evaporating basin = $m_1 g$ Mass of evaporating basin and 20 cm³ saturated solution = $m_2 g$ Final mass of solid KCIO₃ and evaporating basin = $m_3 g$ Mass of water in saturated KCIO₃ solution = $m_2 - m_3 g$ Mass of solid KCIO₃ in saturated solution = $m_3 - m_1 g$ Solubility of KCIO₃ = $\frac{m_3 - m_1}{m_3 - m_1} \times 100$ $m_2 - m_3$
- (iv) KC/O₃ solid is corrosive or caustic. Wear gloves when handling the reagent.



⁽ii) <u>above the transition temperature</u>, The solubility of NaBr increases gradually with temperature.

below the transition temperature.

The gradient of the graph is steeper, hence the solubility of NaBr.2H₂O increases more rapidly with temperature.

Dissolving sodium bromide under equilibrium conditions is endothermic.

2 (a) Elimination

(iii)

(b)









- (b) (i) Add concentrated sulfuric acid to sodium chloride.
 - I⁻ is a stronger reducing agent than Cl^{-} (ii) Most of the HI can be oxidised by concentrated H₂SO₄ to form violet fumes of I₂ gas.

NaI (s) + $H_2SO_4(l)$ $\frac{3}{4}\frac{3}{4}$ ® HI (g) + NaHSO₄ (s) $8 HI (g) + H_2SO_4 (l) \frac{3}{4} \frac{3}{4} \otimes 4 I_2 (g) + H_2S (g) + 4 H_2O (l)$ (iii) $P(s) + 3/2 I_2(s) \frac{3}{4} \frac{3}{4} \mathbb{R}$ PI₃ (s)

or

$$P_4(s) + 6 I_2(s) \frac{3}{4} \frac{3}{4} \otimes 4 PI_3(s)$$

 $PI_3(s) + 3 H_2O(l) \frac{3}{4} \frac{3}{4} \otimes H_3PO_3(aq) + 3 HI(g)$

(C) Benzene in G is more resonance stabilized than alkene in B



4 (a) (i)



After electric +	Asp	Tyr F	Phe	Lys
current applied			●	•

(iii) Aspartic acid and tyrosine formed negative ions and they migrate towards the positive terminal.

Aspartic acid is nearer to the positive terminal than tyrosine as the aspartic acid has a negative charge (-2) and a lower molecular mass than tyrosine.

- (b) (i) Aspartame exist as zwitterions. A large amount of energy needed to break the ionic bonds between the oppositely charged ions
 - (ii) 1 acidic hydrolysis



CH₃OH



Step	Reagent(s) and conditions		
Ι	Aqueous Cl ₂		
II	(Excess) conc. H ₂ SO ₄ 170°C		
III	KMnO4, dilute H2SO4, heat		

5 (a) The electron withdrawing hydroxyl grp decreases the electron density on the lone pair of N atom. Hence, the lone pair on N atom is less available to accept a proton

Hence, *Tris* is less basic than *tert*-butylamine.

(b) $(HOCH_2)_3CNH_2 + H^+ \longrightarrow (HOCH_2)_3CNH_3^+$

 $(HOCH_2)_3CNH_3^+ + OH^- \longrightarrow (HOCH_2)_3CNH_2 + H_2O$

(c) (i) No. of mole of (unreacted) HCl in 105 cm³ = 4.99×10^{-3} [H⁺] = $4.99 \times 10^{-3}/0.105 = 0.04752$ mol dm⁻³ pH = 1.32

(ii) $pOH = 5.93 + \lg \frac{(0.025/V)}{(0.015/V)}$ where V = total volume = 6.15 pH = 7.85

(d) Solution Y has a larger buffering capacity and will much better resist changes in pH upon the addition of a strong acid or base as the concentrations of its buffer components are much larger than that of solution X.



(ii) $E_{cell} = +1.36 - (+0.77) = +0.59 V$

- (b) $E^{q}_{Fe3+/Fe2+}$ is more positive than $E^{q}_{Ru3+/Ru2+}$, the relative stability of +2 oxidation state compared to +3 oxidation state is larger for iron than ruthenium.
- (c) (i) Complex A $[Ru(NH_3)_6]^{3+}$ Compound B $[Ru[(NH_3)_6]^{2+}.2Cl^{-}$ or $Ru[(NH_3)_6].2Cl$ or $Ru(NH_3)_6Cl_2$
 - (ii) $E_{cell} = -0.56 (-0.76) = +0.20V$ Since Fe(OH)₃ can be reduced by Zn, the comported C is Fe(OH)₂

(d)
$$Fe^{3+} + 6F^{-} = [FeF_6]^{3-}Or [Fe(H_2O)_6]^{3+} + 6F^{-} = [FeF_6]^{3-} + 6H_2O$$

(e)

$$K_{c} = \frac{[[FeF_{6}]^{3}}{[Fe^{3+}][F^{-}]^{6}} \qquad K_{c} = \frac{[[FeF_{6}]^{3-}]}{[[Fe(H_{2}O)_{6}]^{3+}][F^{-}]^{6}}$$

- (f) (i) K_c of $[Fe(edta)]^-$ is larger than K_c of $[Fe(SCN)(H_2O)_5]^{2+}$. Edta is a stronger ligand than H_2O and SCN^- and the deep red $[Fe(SCN)(H_2O)_5]^{2+}$ solution changes to yellow $[Fe(edta)]^-$
 - (ii) Addition of edta results in forming [Fe(edta)]²⁻ and [Fe(edta)]⁻. Since K_c of [Fe(edta)]⁻ is greater K_c of [Fe(edta)]²⁻, edta ligand stabilises Fe(III) relative to Fe(II) to a larger extent than water ligand. Hence E^e value is less than +0.77V/decreases.
- (g) $[Fe(CN)_6]^{3-}$ has a partially-filled d orbitals; undergoes d-orbital splitting. During the transition, the d electron absorbs the blue wavelength of light from the visible region of the electromagnetic spectrum and emits the remaining wavelengths which appear as the orange colour of $[Fe(CN)_6]^{3-}$ observed.