Victoria Junior College 2021 H2 Chemistry Prelim Exam 9729/1 **Suggested Answers**

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

A (1, 2 and 3) 1

Option 1: Incorrect

 X^{2+} has 53 electrons, X atom has 55 electrons (protons), X is Cs while Xe has 54 electrons (or protons). Hence, the atom of X is not isoelectronic with the atom of Xe.

Option 2: Incorrect

Both **X**F and RbF have giant ionic structure. Since LE $\alpha |q^+q^-/(r^+ + r^-)|$, as size of **X**⁺ is bigger than Rb⁺, hence **X**F has a less exothermic LE and ionic bond strength in XF is weaker. Hence, XF has a lower melting point than RbF.

Option 3: Incorrect

Since Fr is below Cs, Fr should have a lower first IE as first IE decreases down the group.

Option 4: Correct

Since angle of deflection α (charge / mass)

ion	Na⁺	X ²⁺				
charge / mass	1/23 = 0.0435	2/133 = 0.0150				
Hence, X^{2+} has a smaller angle of deflection.						

2

В **Option A: Correct**

Ethanol, C₂H₅OH, which has a highly electrondeficient H atom (δ +) that is covalently bonded to a highly electronegative O, can be attracted to the lone pair of a highly electronegative atom (δ -), which is O in caffeine through hydrogen bonding.

Option B: Incorrect

Caffeine does not have a planar structure since there are 3 bond pair of electrons and 1 lone pair around each N atom having three single bonds around it, it is trigonal pyramidal about each of these N atoms.

Option C: Correct

Each double bond is made up of 1 sigma and 1 pi bonds while each single bond is made up of only 1 sigma bond.

Option D: Correct

There are 5 carbon atoms having 3 bond pair of electrons around each of them, implying that they are sp² hybridised.

3 Α

Option A: Correct

CH₃CO₂-NH₄⁺ has a giant ionic structure. More energy is required to break the stronger electrostatic forces of attraction between oppositely charged ions. CH₃CH₂NH₂ has a simple molecular structure with weaker hydrogen bonds between molecules. Hence, CH₃CO₂⁻NH₄⁺ has a higher bp.

Option B: Incorrect

SiO₂ has a giant molecular structure while SiCl₄ a simple molecular structure. More energy is required to break the stronger and extensive covalent bonds between atoms in SiO₂ than the id-id interactions between non-polar SiCl₄ molecules. Hence SiO₂ has a higher bp.

Option C: Incorrect

Both PH₃ and SiC*l*₃H exist as simple molecules. SiCl₃H has a larger electron number, hence its electron cloud is more polarisable resulting in stronger id-id interactions between SiC/₃H molecules. Thus SiC*l*₃H has a higher bp.

Option D: Incorrect

Both Ni(OH)₂ and NiSO₄ exist as giant ionic structures. Since SO42- has a higher charge than OH⁻ and LE α |q⁺q⁻/(r⁺+r⁻)|, LE of NiSO₄ is more exothermic and more energy is required to break the stronger ionic bonds in NiSO₄. Hence, NiSO₄ has a higher bp.

4

When the vessel is dented,

pV = nRT

n = pV/RT

Α

 $= (52.8 \times 10^3 \times 38.5 \times 10^{-6}) / [8.31 \times (27 + 273)]$ = 8.15 x 10⁻⁴ mol

Amount of gas remained unchanged when the shape of the vessel is restored. Hence, when the shape of the vessel is restored to 40.0 cm³ at 60 °C, p = nRT/V

 $= [8.15 \times 10^{-4} \times 8.31 \times (60 + 273)] / (40.0 \times 10^{-6})$ = 56.4 kPa

5 В

Al₂O₃ is an amphoteric oxide while SiO₂ is an acidic oxide. Since both solutions prepared can dissolve Al₂O₃, but only one can dissolve SiO₂, one solution must be basic while the other solution must be acidic.

		Y (chloride of Y)	Z (oxide of Z)
x	Α	silicon	phosphorus
		(SiCl ₄ : acidic)	(P ₄ O ₁₀ : acidic)
~	в	phosphorus	sodium
		(PCl ₅ : acidic)	(Na ₂ O: basic)
x	С	magnesium	phosphorus
		(MgCl ₂ : acidic)	(P ₄ O ₁₀ : acidic)
x	D	sodium	sulfur
		(NaCl: neutral)	(SO ₃ : acidic)

Hence, Y is P while Z is Na.

Chloride of **Y**: $PCl_5 + 4H_2O \rightarrow H_3PO_4 + 5HCl$ Oxide of **Z**: Na₂O + H₂O \rightarrow 2NaOH

For reaction with Al₂O₃: $2H_3PO_4 + Al_2O_3 \rightarrow 2A/PO_4 + 3H_2O_3$ 2NaOH + Al_2O_3 + $3H_2O \rightarrow 2NaAl(OH)_4$

For reaction with SiO₂: H_3PO_4 + SiO₂ \rightarrow no reaction 2NaOH(conc.) + SiO₂ \rightarrow Na₂SiO₃ + H₂O

6

D

Based on the melting point data, the four elements are Si (Group 14) (high melting point due to giant molecular structure), P₄ (Group 15), S₈ (Group 16) and Cl_2 (Group 17).

Property is electronegativity Х since electronegativity increases across the period. Property Y is 3rd IE since there is an anomaly at Group 15 element.

Si²⁺ \rightarrow Si³⁺ + e 3s² 3s¹ P^{2+} $\rightarrow P^{3+} + e$ $3s^2 3p^1$ 3s²

For P^{2+} , an electron is removed from the 3p subshell which is further away from the nucleus. Thus, the 3p subshell is of a higher energy and its electron is less strongly attracted to the nucleus and hence less energy is required to remove it.

7

С **Option A: Incorrect**

Ba²⁺ has a lower charge density than Mg²⁺ due to its smaller ionic radius, hence, BaCl₂ undergoes smaller extent of hydrolysis than MgCl₂, which results in a higher pH.

Option B: Incorrect

 $MCO_3 \rightarrow MO + CO_2$

1 mol of MCO₃ will decompose to form 1 mol of CO_2 . As M_r of MCO₃ increases down the group, amount of 1 g of MCO3 will decrease down the group. Hence, smaller amount and volume of CO₂ gas will be produced.

Option C: Correct

Mg reacts less vigorously with cold water than strontium as the $E^{\circ}(Sr^{2+}|Sr)$ is less positive / more negative than that of $E^{\bullet}(Mg^{2+}|Mg)$. Hence, Sr tends to be oxidised to Sr(OH)₂ more readily than Mg.

Option D: Incorrect

Group 2 sulfates become less soluble down the group since $|\Delta H_{hyd}|$ decreases as cations become larger in size, while $|\Delta H_{LE}|$ remains relatively constant due to large size of sulfate. Indeed, barium sulfate has a weaker ionic bond strength. It has less exothermic lattice energy since ionic radius of Ba²⁺ is larger than that of Mg²⁺.

8 D

From expt 1, Y^- is oxidised to Y_2 by X_2 . With Y_2 appearing as violet in organic layer, $Y_2 = I_2$ and oxidising strength: $X_2 > Y_2$.

From expt 2, X^- is oxidised to X_2 by Z_2 . With X_2 appearing as orange-red in organic layer, $X_2 = Br_2$ and oxidising strength: Z₂ > X₂.

From expt 3, \mathbf{Y}^- is oxidised to \mathbf{Y}_2 by \mathbf{Z}_2 . With \mathbf{Y}_2 appearing as violet in organic layer, $Y_2 = I_2$ and oxidising strength: $Z_2 > Y_2$.

Hence, oxidising strength: $Z_2 > X_2 > Y_2$ \Rightarrow Z₂ = Cl₂, X₂ = Br₂, Y₂ = I₂

Option A: Incorrect

HY (HI) has the highest boing point among three hydrogen halides due to its strongest instantaneous dipole-induced dipole interactions between molecules since HY (HI) has the largest number of electrons.

Option B: Incorrect

 K_{sp} of AgY (AgI) is so low that even at high concentration of NH₃, the ionic product of AgY is still greater than its K_{sp} value. Hence, AgY (AgI) does not dissolve in both dilute and concentrated NH₃.

Option C: Incorrect

HY (HI) is a stronger acid than HZ (HCl), hence HY has a larger K_a value. Since atomic radius of Y is larger than than of Z, H-Y bond is weaker than H-Z bond and less energy is needed to overcome H-Y bond to dissociate HY into H⁺ and Y⁻.

Option D: Correct

For expt 4, since Y_2 is a weaker oxidising agent than X_2 , Y_2 will not be able to oxidise X^- to X_2 . Hence, no redox reaction occurs and Y_2 (I₂) will appear as violet in organic layer, which is the same as expt 3.

q С

CO32- in sodium percarbonate reacts with sulfuric acid to form CO_2 gas:

$$\begin{array}{l} \text{CO}_3^{2-} + 2\text{H}^+ \rightarrow \text{CO}_2 + \text{H}_2\text{O} \\ \text{n}(\text{CO}_3^{2-}) &= \text{n}(\text{CO}_2) \\ &= 48 \ / \ 24000 = 2.00 \ \times \ 10^{-3} \ \text{mol} \end{array}$$

H₂O₂ is oxidised by MnO₄⁻: MnO_4^- + $8H^+$ + $5e^- \rightarrow Mn^{2+}$ + $4H_2O$ $H_2O_2 \rightarrow O_2 + 2H^+ + 2e^-$ 2 MnO₄⁻ : 5 H₂O₂ $n(H_2O_2) = \frac{5}{2} \times n(MnO_4)$ $=\frac{5}{2} \times \frac{24}{1000} \times 0.0500 = 3.00 \times 10^{-3}$ $\frac{y}{2} = n(H_2O_2) / n(CO_3^{2-})$ $= (3.00 \times 10^{-3}) / (2.00 \times 10^{-3})$ $= \frac{3}{2}$

10

10 B							
	CS _z +	(1 + z)O ₂	\rightarrow	CO ₂ +	zSO_2		
Initial / cm ³	20	80		0	0		
Change / cm ³	-20	-20(1 + <i>z</i>)		+20	+20z		
End / cm ³	0	80 – 20(1 + <i>z</i>)		20	20 <i>z</i>		

Gas mixture after combustion contains unreacted O₂, CO₂ and SO₂. Upon treatment with NaOH(aq), the acidic gases, CO2 and SO2, are removed. Hence,

volume after treatment with NaOH(ag) = volume of unreacted O_2 = 20

80 - 20(1 + z) = 2060 - 20z = 20z = 2

11 B (1 and 4 only) $\Delta H_{\rm r}^{\rm e} = 790$ = $\Sigma(\Delta H_f)_{\text{products}} - \Sigma(\Delta H_f)_{\text{reactants}}$

= $3x\Delta H_f(CO) - \Delta H_f(Cr_2O_3)$

 $\Delta H_{\rm f}(\rm Cr_2O_3) = 3x \Delta H_{\rm f}(\rm CO) - 790$

Hence, to find $\Delta H_f(Cr_2O_3)$, the value of $\Delta H_f(CO)$, enthalpy change of formation of CO, needs to be known, which, however, is not one of the options.

Now consider the definition of $\Delta H_{\rm f}(\rm CO)$: $C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g) \quad \Delta H_f(CO)$ $\Delta H_{\rm f}(\rm CO) = \Sigma (\Delta H_{\rm c})_{\rm reactants} - \Sigma (\Delta H_{\rm c})_{\rm products}$ $= \Delta H_{\rm c}({\rm C}) - \Delta H_{\rm c}({\rm CO})$

Since $\Delta H_f(CO)$ can, in turn, be found from $\Delta H_c(C)$ and $\Delta H_{c}(CO)$, the enthalpy changes of combustion of C and CO, answer is options (1) and (4).

12 D

Since ammonium nitrate functions as a 'cold pack', this suggests that the temperature decreases when it dissolves. Hence, the dissolution process is endothermic, i.e. ΔH is positive.

The dissolution process involves mixing of particles, which leads to more ways of arranging them. Hence, amount of disorder increases, i.e. ΔS is positive.

 $\Delta G = \Delta H - T \Delta S$

= $|\Delta H| - T |\Delta S|$ for positive ΔH and ΔS .

For reaction to be spontaneous, ΔG has to be negative. In this case, ΔG is negative only when temperature is high enough for $T |\Delta S|$ to exceed $|\Delta H|$, i.e. reaction is more spontaneous at higher temperatures.

13 C (2 and 3 only) **Option 1: Wrong**

Whether the reaction proceeds via free radicals cannot be determined just from the rate equation.

Option 2: Correct

If the reaction is a single-step reaction, the overall equation will also be the rate-determining step of the mechanism. Hence. the stoichiometry coefficient in the overall equation will coincide with the order shown in the rate equation. This is seen in the hydrogen / iodine reaction but not in the hydrogen / bromine reaction.

Option 3: Correct

From the given rate equation for the hydrogen / bromine reaction, rate decreases as [HBr] increases.

14 D

Since reaction is first order, half life is constant. When the ratio of U : Pb is 1:15, it suggests that only 1/16 of U is left.

 $(\frac{1}{2})^4 = 1/16$

This constitutes 4 half-lives and hence the rock sample is 2840 million years old.

15

Α

When 0.10 mol of R is added to the old equilibrium mixture, the system is no longer at equilibrium. The new initial amounts are now:

By Le Chatelier's Principle, the system will try to remove the additional amount of R added by shifting the equilibrium backwards.

	P (g) +	Q (g)	\Rightarrow	2 R (g)
Initial / mol	0.5	0.5		0.3
Change / mol	+x/2	+x/2		-x
Eqm / mol	0.5 + (x/2)	0.5 + (x/2)		0.3 – x

 $K_{\rm c}$ remains the same since temperature is unchanged.

 $K_{\rm c} = 0.16 = \frac{[{\rm R}]^2}{[{\rm P}][{\rm Q}]} = \frac{[(0.3 - {\rm x})/{\rm V}]^2}{[(0.5 + {\rm x}/2)/{\rm V}]^2}$ where V = vol. of the sealed vessel $\Rightarrow \sqrt{0.16} = 0.4 = \frac{(0.3 - x)}{(0.5 + x/2)}$ $\Rightarrow 0.2 + 0.2x = 0.3 - x$ $\Rightarrow x = 0.0833$

Amount of R in the new equilibrium = 0.3 - x = 0.3 - 0.0833 = 0.22 mol

16

С

 $K_{\rm w} = [{\rm H}^+][{\rm O}{\rm H}^-] = 2.4 \times 10^{-14}$ $pH = 7.4 \Rightarrow [H^+] = 10^{-7.4}$ Substituting into *K*_w expression: 10^{-7.4} [OH⁻] = 2.4 × 10⁻¹⁴ $[OH^{-}] = 6.03 \times 10^{-7} \text{ mol dm}^{-3}$

17 B (1 and 2 only)

 $CH_3CO_2H \rightleftharpoons CH_3CO_2^- + H^+ ---- (1)$

Option 1: Correct

When solution is diluted, [CH₃CO₂H], [CH₃CO₂⁻] and [H⁺] decrease.

The ratio $[CH_3CO_2^-][H^+] / [CH_3CO_2H]$ becomes smaller than K_a . Hence, equilibrium (1) shifts right so that $[CH_3CO_2^-][H^+] / [CH_3CO_2H] = K_a$ again.

As solution is diluted to an increasing extent, equilibrium (1) shifts more to the right, leading to a higher fraction of CH_3CO_2H dissociated. The fraction of CH_3CO_2H will increase to a maximum value of 1 at infinite dilution.

Option 2: Correct

$[H^+] = \sqrt{K_a[HA]}$

As solution is diluted to an increasing extent, [HA] decreases, leading to lower [H⁺] and higher pH. pH will increase to a maximum value of 7 at infinite dilution, when the solution is almost like pure water.

Option 3: Wrong

D

 K_a is only dependent on temperature and is hence unaffected by dilution.

18

 $Zn_3[Fe(CN)_6]_2(s) \Rightarrow 3Zn^{2+}(aq) + 2[Fe(CN)_6]^{3-}(aq)$ Let concentration of the anion be x mol dm⁻³. Hence, $[Zn^{2+}] = \frac{3}{2}x$

 $K_{sp} = [Zn^{2+}]^3 [anion]^2$ W = $(\frac{3}{2}x)^3 x^2 = \frac{27}{8}x^5$ ⇒ x = $(\frac{8}{27}W)^{1/5}$

19 A

First step:

P has lone pair electrons which acts as a nucleophile by attacking electron deficient C bonded directly to X via **nucleophilic substitution**.

Second step:

1) **Neutralisation** occurs between basic H^- and CHR(R')(⁺PPh₃), in which CHR(R')(⁺PPh₃) acts as an acid by donating H^+ to form carbanion $^-CR(R')(PPh_3)$.

2) ⁻CR(R')(PPh₃) then acts as a nucleophile by attacking electron deficient C bonded directly to O in propanone via **nucleophilic addition**.

Third step:

D

Condensation has occurred via nucleophilic addition (second step) followed by elimination of $O=PPh_3$ (third step).

20

CH(CH₃)₂COOH: 2-methylpropanoic acid CH₃CH₂CH₂COOH: butanoic acid CH₃CH₂COOCH₃: methyl propanoate HCOOCH₂CH₂CH₃: propyl methanoate CH₃COOCH₂CH₃: ethyl ethanoate HCOOCH(CH₃)₂: 1-methylethyl methanoate

21 B

Option 1: Incorrect

Conc. H_2SO_4 is used instead as a dehydrating agent while aqueous H_2SO_4 is completely dissociated into ions.

Option 2: Incorrect

The formation of carbocation in step 2 is not likely for primary alcohols as compared to tertiary alcohols since primary carbocation is less stable than tertiary carbocation.

Option 3: Correct

The reactants in step 3 can undergo addition reaction to give $CH_3CH(OSO_3H)CH_3$.

22 D

Primary alcohol will be oxidised to carboxylic acid, secondary alcohol to ketone and no oxidation for tertiary alcohol.

Hence the compound **X** is



Molecular formula is C₅H₆O₆



24 C Options A and B: Incorrect

LiA/H₄ in dry ether is unable to reduce alkene.

Option C: Correct

Both aldehyde and alkene functional groups will be reduced by H₂, Pt. Only the primary alcohol will be oxidised by $K_2Cr_2O_7$ with $H_2SO_4(aq)$, heat to form $-CO_2H$.

Option D: Incorrect

 $KMnO_4$ with $H_2SO_4(aq)$, heat will cause both $-CH_2OH$ and $-CH_2CH_2CH_3$ side chains on the benzene ring to be oxidised to $-CO_2H$ as both side chains have a benzylic hydrogen.

25 D

Option A: Correct

Acid hydrolysis of the ester can occur first to form CH_3CH_2OH as one product. This will be oxidised by acidified $K_2Cr_2O_7$ to CH_3CO_2H , hence colour of the solution turns green.

Option B: Correct

2,4-DNPH only forms orange crystals with carbonyl compounds. Ester is not a carbonyl compound.

Option C: Correct

Alkaline hydrolysis of the ester can occur first to form CH₃CH₂OH as one product. This will give a positive triiodomethane test as it contains CH₃CH(OH)- unit.

Option D: Incorrect

Both electrophilic addition of alkene and electrophilic substitution of phenylamine can occur. Thus 2 Br atoms will be incorporated into a molecule of the major product. Major product is as follows:



26

С **Option A: Incorrect**

It contains an aromatic aldehyde (benzaldehyde), and has no reaction with Fehling's solution.

Option B: Incorrect

It does not tally with the molecular formula. There are 3 oxygen atoms in the compound, but the question wants only 2 oxygen atoms.

Option C: Correct

It is moderately soluble in water as it can exist as a zwitterion, comprising NH_3^+ and phenoxide group. It contains aliphatic aldehvde which gives a brick red ppt when warmed with Fehling's solution. It has phenol which gives a purple colouration when warmed with neutral FeCl₃.

Option D: Incorrect

С

Carboxylic acid does not give purple colouration with FeCl₃(aq) nor react with Fehling's solution.

27

The conjugate acid of the weakest base is the strongest acid with the highest K_a and lowest pK_a. Phenylamine, C₆H₅NH₂, is the weakest base as the N lone pair is delocalized into the aromatic ring making it least available for donation to an acid.

Diethylamine, (CH₃CH₂)NH is a stronger base than ammonia as it contains alkyl groups which exert electron-donating inductive effect making the lone pair on its N more available for donation to an acid.

28 Α

Option A: Correct

Compound A undergoes oxidation in reaction I and then condensation in reaction II to form



NH(CH₃) NH(CH₃)

Molecular formula changes from C₃H₄O₃ to $C_5H_{10}O_2N_2$. There is an increase of M_r by 42.0.

Option B: Incorrect

Compound A undergoes condensation in reaction I to form (CHO)CH₂CONH(CH₃) which then undergoes hydrolysis (amide to carboxylic acid) and oxidation (aldehyde to carboxylic acid) in

0.



reaction II to form

Molecular formula changes from $C_3H_4O_3$ to $C_3H_4O_4$. There is an increase of M_r by 16.0.

Option C: Incorrect

There is no oxidation of compound **A** in reaction **I**. It undergoes condensation in reaction II to form



Molecular formula changes from C₃H₄O₃ to $C_4H_7O_2N$. There is an increase of M_r by 13.0.

Option D: Incorrect

Although compound **A** forms an amide CH₃COCONH(CH₃) in reaction I, it undergoes acid hydrolysis in reaction II to give back the same compound A. There is no oxidation of ketone functional group. There is no change in M_r .

29 A (1, 3 and 4 only)

For cell 1, Y is anode (–) while X is cathode (+). \Rightarrow Oxidation occurs at electrode Y; reduction at electrode X.

 $E_{\text{cell}} = E_{\text{reduced}} - E_{\text{oxidised}}$ $= E(X^{2+}|X) - E(Y^{2+}|Y) = +0.47 V --(1)$ $\Rightarrow E(X^{2+}|X) > E(Y^{2+}|Y)$ For cell 2, X is anode (-) while Z is cathode (+). \Rightarrow Oxidation occurs at electrode X; reduction at electrode Z. $E_{\text{cell}} = E_{\text{reduced}} - E_{\text{oxidised}}$ $= E(Z^{2+}|Z) - E(X^{2+}|X) = +0.31 \text{ V} --(1)$

Option 1: Correct

Since $E(Z^{2+}|Z)$ is the most positive, Z is the least easily oxidised, hence Z is the weakest RA.

Option 2: Incorrect

Similarly, since $E(Y^{2+}|Y)$ is the least positive, Y^{2+} is the least easily reduced, hence Y2+ is the weakest OA and hence cannot oxidise both X and Z.

Option 3: Correct

Since $E(X^{2+}|X) - E(Y^{2+}|Y) = +0.47 V --(1)$ $E(Z^{2+}|Z) - E(X^{2+}|X) = +0.31 \text{ V} --(2)$

amide

NH(CH₃)

When the two half-cells of $Y^{2+}(aq)|Y(s)$ and $Z^{2+}(aq)|Z(s)$ are connected together, since $E(Z^{2+}|Z) > E(Y^{2+}|Y)$, reduction will take place at Z electrode while oxidation will take place at Y electrode.

 $\Rightarrow E_{\text{reduced}} = E(Z^{2+}|Z) \text{ and } E_{\text{oxidised}} = E(Y^{2+}|Y)$ By (1) + (2) $E_{\text{cell}} = E(Z^{2+}|Z) - E(Y^{2+}|Y) = 0.31 + 0.47 = + 0.78 \text{ V}$

Option 4: Correct

 $X^{2+} + 2e \rightleftharpoons X$

By Le Chatelier's Principle, adding water to $X^{2+}|X$ will decrease $[X^{2+}]$, causing the position of above equilibrium to shift to the left to increase the concentration of X^{2+} . $E(X^{2+}|X)$ becomes less positive.

Hence,

For electrochemical cell 1: $E_{cell} = E(X^{2+}|X) - E(Y^{2+}|Y)$ will decrease For electrochemical cell 2: $E_{cell} = E(Z^{2+}|Z) - E(X^{2+}|X)$ will increase

30 C

Quantity of charge transferred, Q = It = $3 \times 2 \times 3600$ = 21600 CNo, of electrons transferred, n_{e-} = Q / 96500 = 21600 / 96500= 0.224 molCu²⁺ + 2e \rightarrow Cu

 $\begin{array}{l} n_{Cu2^{+}} = 0.224 \ / \ 2 \\ = 0.112 \ \text{mol} \\ \text{Hence, } [Cu^{2^{+}}] \ x \ 0.500 \ = 0.112 \\ [Cu^{2^{+}}] \ = 0.224 \ \text{mol} \ dm^{-3} \end{array}$

Since change in $[Cu^{2+}]$ is 0.224 mol dm⁻³, $[Cu^{2+}]_{left} = [Cu^{2+}]_{initial} - Change in [Cu^{2+}]$ 0.776 = $[Cu^{2+}]_{initial} - 0.224$ $[Cu^{2+}]_{initial} = 1.00 \text{ mol dm}^{-3}$