Mark Scheme (Results)

Summer 2017

Pearson Edexcel GCE
in Chemistry (6CH05) Paper 01
General Principles of Chemistry II – Transition Metals and Organic Nitrogen Chemistry

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General marking guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- Mark schemes will indicate within the table where, and which strands of QWC, are being assessed. The strands are as follows:

  i) ensure that text is legible and that spelling, punctuation and grammar are accurate so that meaning is clear
  ii) select and use a form and style of writing appropriate to purpose and to complex subject matter
  iii) organise information clearly and coherently, using specialist vocabulary when appropriate

Using the mark scheme

Examiners should look for qualities to reward rather than faults to penalise. This does NOT mean giving credit for incorrect or inadequate answers, but it does mean allowing candidates to be rewarded for answers showing correct application of principles and knowledge. Examiners should therefore read carefully and consider every response: even if it is not what is expected it may be worthy of credit.

The mark scheme gives examiners:
- an idea of the types of response expected
- how individual marks are to be awarded
- the total mark for each question
- examples of responses that should NOT receive credit.

/ means that the responses are alternatives and either answer should receive full credit.
( ) means that a phrase/word is not essential for the award of the mark, but helps the examiner to get the sense of the expected answer.
Phrases/words in **bold** indicate that the meaning of the phrase or the actual word is **essential** to the answer.
ecf/TE/cq (error carried forward) means that a wrong answer given in an earlier part of a question is used correctly in answer to a later part of the same question.

Candidates must make their meaning clear to the examiner to gain the mark. Make sure that the answer makes sense. Do not give credit for correct words/phrases which are put together in a meaningless manner. Answers must be in the correct context.

Quality of Written Communication

Questions which involve the writing of continuous prose will expect candidates to:
- write legibly, with accurate use of spelling, grammar and punctuation in order to make the meaning clear
- select and use a form and style of writing appropriate to purpose and to complex subject matter
- organise information clearly and coherently, using specialist vocabulary when appropriate.

Full marks will be awarded if the candidate has demonstrated the above abilities.
Questions where QWC is likely to be particularly important are indicated (QWC) in the mark scheme, but this does not preclude others.

Section A (multiple choice)

Question Number	Correct Answer	Mark
1	**1. The only correct answer is C** ***A*** *is not correct because neither Al nor H has oxidation number +5* ***B*** *is not correct because neither K nor Mn has oxidation number +5* ***D*** *is not correct because neither Fe, C nor N has oxidation number +5*	**(1)**

Question Number	Correct Answer	Mark
2	**2. The only correct answer is A** ***B*** *is not correct because I disproportionates from 0 to +5 and -1* ***C*** *is not correct because O disproportionates from -1 to -2 and 0* ***D*** *is not correct because Cu disproportionates from +1 to +2 and 0*	**(1)**

Question Number	Correct Answer	Mark
3	**3. The only correct answer is C** ***A*** *is not correct because zinc atoms would be oxidised by hydrogen ions* ***B*** *is not correct because zinc is the negative electrode so does not gain electrons* ***D*** *is not correct because zinc atoms lose electrons to hydrogen ions*	**(1)**

Question Number	Correct Answer	Mark
4	**4. The only correct answer is C** ***A*** *is not correct because the electrode potential of the cell containing iron(II) ions is less positive than the one containing Vanadium (III) ions* ***B*** *is not correct because iron is a reducing agent* ***D*** *is not correct because silver is a reducing agent*	**(1)**

Question Number	Correct Answer	Mark
5	**5. The only correct answer is A** ***B*** *is not correct because there is no hydrogen gas present* ***C*** *is not correct because the reaction must supply electrons* ***D*** *is not correct because the reaction must supply electrons*	**(1)**

Question Number	Correct Answer	Mark
6	**6. The only correct answer is B** ***A*** *is not correct because nickel(II) ions form a soluble complex with ammonia* ***C*** *is not correct because nickel(II) ions form a soluble complex with ammonia* ***D*** *is not correct because nickel(II) hydroxide is not soluble in excess NaOH*	**(1)**

Question Number	Correct Answer	Mark
7	**7. The only correct answer is D** ***A*** *is not correct because the product is not* $S_4O_6^{2-}$ *ions* ***B*** *is not correct because the product is not* $S_4O_6^{2-}$ *ions* ***C*** *is not correct because the charges are not balanced*	**(1)**

Question Number	Correct Answer	Mark
8	**8. The only correct answer is D** ***A*** *is not correct because the end point could still be seen* ***B*** *is not correct because the starch is not decomposed* ***C*** *is not correct because the blue-black colour would be seen*	**(1)**

Question Number	Correct Answer	Mark
9	**9. The only correct answer is A** ***B*** *is not correct because infrared spectroscopy does not measure bond length* ***C*** *is not correct because the enthalpy changes do not measure bond length* ***D*** *is not correct because the rates of reaction do not measure bond length*	**(1)**

Question Number	Correct Answer	Mark
10	**10. The only correct answer is B** ***A*** *is not correct because* SO_3H *is substituted* ***C*** *is not correct because* SO_3H *is substituted* ***D*** *is not correct because* SO_3H *is substituted*	**(1)**

Question Number	Correct Answer	Mark
11	**11. The only correct answer is B** ***A*** *is not correct because the electrophile which forms is* CH_3CO^+ ***C*** *is not correct because the electrophile which forms is* CH_3CO^+ ***D*** *is not correct because the electrophile which forms is* CH_3CO^+	**(1)**

Question Number	Correct Answer	Mark
12	**12. The only correct answer is C** ***A*** *is not correct because there is no doublet in the spectrum* ***B*** *is not correct because there is no sextet on the spectrum* ***D*** *is not correct because there is no doublet in the spectrum*	**(1)**

Question Number	Correct Answer	Mark
13	**13. The only correct answer is B** ***A*** *is not correct because the bonds are too similar to be distinguished by infrared* ***C*** *is not correct because the splitting patterns will be the same* ***D*** *is not correct because the number of peaks in the low resolution spectra*	**(1)**

Question Number	Correct Answer	Mark
14	**14. The only correct answer is D** ***A*** *is not correct because there is no alcohol or phenol to give the peak at above 3300cm^{-1}* ***B*** *is not correct because there is no alcohol or phenol to give the peak at above 3300cm^{-1}* ***C*** *is not correct because there is no alcohol or phenol to give the peak at above 3300cm^{-1}*	**(1)**

Question Number	Correct Answer	Mark
15	**15. The only correct answer is A** ***B*** *is not correct because it does not form an alkaline solution* ***C*** *is not correct because it is not very soluble in water* ***D*** *is not correct because it does not form an alkaline solution*	**(1)**

Question Number	Correct Answer	Mark
16	**16. The only correct answer is B** ***A*** *is not correct because the property which is essential is that the capsule is water soluble to release the detergent* ***C*** *is not correct because the property which is essential is that the capsule is water soluble to release the detergent* ***D*** *is not correct because the property which is essential is that the capsule is water soluble to release the detergent*	**(1)**

Question Number	Correct Answer	Mark
17	**17. The only correct answer is A** ***B*** *is not correct because the OH and* $CONH_2$ *groups will not react to form a polymer* ***C*** *is not correct because the number of* (CH_2) *groups o in the polymer is incorrect* ***D*** *is not correct because the OH and* NH_2 *groups will not react to form a polymer*	**(1)**

Question Number	Correct Answer	Mark
18	**18. The only correct answer is C** ***A*** *is not correct because 1 mol alcohol gives 4 mol* CO_2 *so 4C are present* ***B*** *is not correct because 1 mol alcohol gives 4 mol* CO_2 *so 4C are present* ***D*** *is not correct because 1 mol alcohol gives 4 mol* CO_2 *so 4C are present*	**(1)**

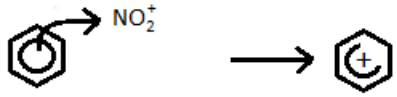
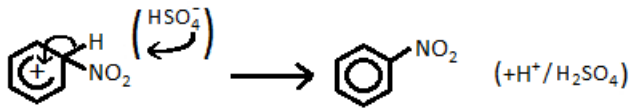
Question Number	Correct Answer	Mark
19(a)	**19(a). The only correct answer is C** ***A*** *is not correct because theoretical yield =* *(2 x 181/136) = 2.66g* *so % yield = (1.5/2.66) x 100* ***B*** *is not correct for the same reason* ***D*** *is not correct for the same reason*	**(1)**

Question Number	Correct Answer	Mark
19(b)	**19(b). The only correct answer is D** ***A*** *is not correct because some product would remain dissolved in excess ethanol* ***B*** *is not correct because the ethanol should be warmed until all the crude solid dissolves, which is not related to its boiling point* ***C*** *is not correct because slow filtration could cause crystallisation in the filter funnel*	**(1)**

Total for Section A = 20 MARKS

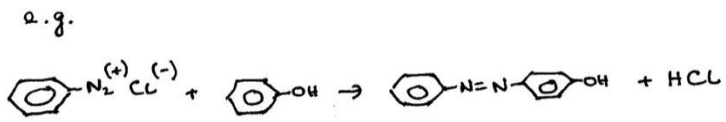
Section B

Question Number	Acceptable Answers	Reject	Mark
20(a)(i)	Concentrated nitric acid/ HNO_3 **and** concentrated sulfuric acid/H_2SO_4 ALLOW Concentrated nitric and sulfuric acid(s) IGNORE References to temperature	Nitric acid and concentrated sulfuric acid Nitrous acid HNO_2	**(1)**

Question Number	Acceptable Answers	Reject	Mark
20(a)(ii)	$H_2SO_4 + HNO_3 \rightarrow NO_2^+ + H_2O + HSO_4^-$ OR $H_2SO_4 + HNO_3 \rightarrow H_2NO_3^+ + HSO_4^-$ **and** $H_2NO_3^+ \rightarrow NO_2^+ + H_2O$ OR $2H_2SO_4 + HNO_3 \rightarrow NO_2^+ + H_3O^+ + 2HSO_4^-$ IGNORE state symbols even if incorrect **(1)**   Curly arrows from on or within the circle to N of NO_2^+ ALLOW Curly arrow from anywhere within the hexagon curly arrow to any part of the NO_2^+ including the + charge **(1)** Intermediate structure including charge with horseshoe covering at least 3 C atoms **and** facing the tetrahedral carbon **and** some part of the + charge must be within the horseshoe **(1)** Curly arrow **from C-H bond** to anywhere in the hexagon reforming the delocalised structure **(1)** Correct Kekule structures score full marks IGNORE Any involvement of HSO_4^- in the final step	Curly arrow on or outside the hexagon Dotted bonds to H and NO_2 unless clearly part of a 3D structure	**(4)**

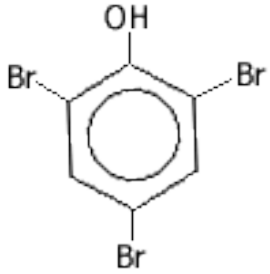
Question Number	Acceptable Answers	Reject	Mark
20(a)(iii)	**X** = $C_6H_5NH_2$ /phenylamine / aniline/ aminobenzene/ $C_6H_5NH_3^+$ Cl^- /phenylammonium chloride/ aniline hydrochloride **(1)** Reagents: Sn/ tin **and** (concentrated) hydrochloric acid/ HCl (followed by NaOH) ALLOW Iron/Fe for Sn **(1)** IGNORE Mention of catalyst Second mark is **independent** of first	Dilute HCl	**(2)**

Question Number	Acceptable Answers	Reject	Mark
20(a)(iv)	Reagents: Sodium nitrite/ potassium nitrite/ $NaNO_2$/ KNO_2 **and** hydrochloric acid/ HCl ALLOW Nitrous acid / HNO_2 **and** hydrochloric acid /HCl **(1)** IGNORE concentration of acid Condition: temperature between 0(^oC) and 10(^oC)/ less than 10(^oC) **(1)**	Just H^+ for an acid	**(2)**

Question Number	Acceptable Answers	Reject	Mark
20(b)	Equation using phenol, phenylamine or other compound with **activated** benzene ring and HCl as one product e.g.  Structure of dye including azo link / -N=N- **(1)** Rest of equation ALLOW TE on incorrect reagent provided -N=N- linking two benzene rings Use of NaOH (as solvent for phenol) giving NaCl Any position of substitution on ring **(1)**	Use of chloro-benzene/ nitro-benzene	**(2)**

Question Number	Acceptable Answers	Reject	Mark
20(c)	Hydrochloric acid / HCl / any strong acid/ $H^+(aq)$ OR NaOH **followed by** hydrochloric acid / HCl IGNORE concentration , addition of water	HCN "NaOH **with** HCl"	**(1)**

Question Number	Acceptable Answers	Reject	Mark
20(d)(i)	$C_6H_5N_2Cl + H_2O \rightarrow N_2 + HCl + C_6H_5OH$ N_2 as a product **(1)** Rest of the equation **(1)** IGNORE state symbols even if incorrect.	O_2 as a reagent	**(2)**

Question Number	Acceptable Answers	Reject	Mark
20(d)(ii)	 ALLOW Kekule / $C_6H_2(OH)Br_3$ /$C_6H_2OHBr_3$ **(1)**	monobromophenol	**(1)**

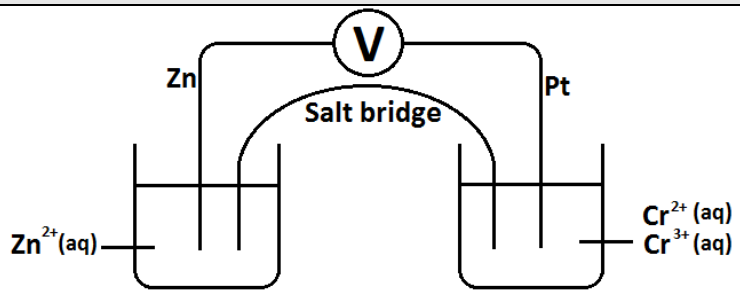
(Total for Question 20 = 15 marks)

Question Number	Acceptable Answers	Reject	Mark
21(a)(i)	Electrons are removed from 4s (orbital) in each element **(1)** Shielding (by 3d electrons) is the same in each element OR Increase in nuclear charge/ proton number is balanced by increase in number of shielding/3d electrons **(1)**		**(2)**

Question Number	Acceptable Answers	Reject	Mark
***21(a)(ii)**	**MP1** In Cr^+ the (second) electron is lost from the 3d subshell **and** in V^+ and Mn^+ it is lost from the 4s subshell **(1)** **MP2 and MP3** Any **TWO** of 3d is closer to nucleus than 4s, harder to remove **(1)** OR 3d is not as well shielded as 4s, harder to remove **(1)** OR 3d is half full so relatively stable, harder to remove **(1)**		**(3)**

<table>
<tr><th>Question Number</th><th>Acceptable Answers</th><th>Reject</th><th>Mark</th></tr>
<tr><td>21(b)(i)</td><td>
<table>
<tr><td>Ion</td><td>Oxidation number of chromium</td><td>Colour in aqueous solution</td></tr>
<tr><td>$Cr(H_2O)_6^{2+}$</td><td>+2</td><td>Blue</td></tr>
<tr><td>$Cr(H_2O)_6^{3+}$</td><td>+3</td><td>Green
ALLOW
violet</td></tr>
<tr><td>CrO_4^{2-}</td><td>+6</td><td>Yellow</td></tr>
<tr><td>$Cr_2O_7^{2-}$</td><td>+6</td><td>Orange</td></tr>
</table>
Oxidation number and colour for $Cr(H_2O)_6^{3+}$ (1)
Oxidation number and colour for CrO_4^{2-} (1)
Oxidation number and colour for $Cr_2O_7^{2-}$ (1)
ALLOW
1 mark for any two correct responses
2 marks for any four correct responses
2+ for +2 etc.
Dark/ light along with colour
</td><td>purple</td><td>(3)</td></tr>
</table>

Question Number	Acceptable Answers	Reject	Mark
***21(b)(ii)**	**MP1** (3)d orbital**s** are split/ (3)d subshells are split (by the attached ligands) **(1)** **MP2** Electrons are promoted (from lower to higher energy d orbital(s)/ levels OR Electrons are moved from lower to higher energy (d (orbital(s) / levels) ALLOW d-d transitions occur/ electrons are excited **(1)** **MP3** absorbing energy/ photons of a certain frequency (in the visible region) ALLOW Absorbing light **(1)** **MP4** Transmitted/ remaining/ reflected light is coloured/ is in the visible region ALLOW Complementary colour seen (The frequency of) transmitted/ remaining /reflected light/ is seen **(1)** Penalise omission of (3)d once only. Ignore reference to electrons relaxing/dropping to the ground state	Emitted light	**(4)**

Question Number	Acceptable Answers	Reject	Mark
21(b)(iii)	 **MP1** Beaker with Zn electrode in $Zn^{2+}(aq)$ **and** salt bridge **and** voltmeter **(1)** **MP2** beaker with Pt electrode in mixture of Cr^{2+}, Cr^{3+} **(1)** **MP3** All solutions 1 mol dm^{-3} (with respect to the ions) **and** T = 298 K ALLOW Concentrations given for one beaker only 1M for1 mol dm^{-3} **(1)** ALLOW diagram with Zn electrode on right. IGNORE References to pressure	Salt bridge not dipping into solution 1 mol	**(3)**

Question Number	Acceptable Answers	Reject	Mark
21(b)(iv)	$Zn^{2+}(aq)\|Zn(s)$ $E^{\ominus} = -0.76$ (V) **and** $Cr^{3+}(aq)\|Cr^{2+}(aq)$ $E^{\ominus} = -0.41$ (V) **(1)** $E^{\ominus}_{cell}$ = (-0.41-(-0.76)) = (+)0.35 (V) **(1)** Correct answer including sign **+**0.35 with no working scores two Value of 0.35 with no sign and no working scores 1 No TE on incorrect data		**(2)**

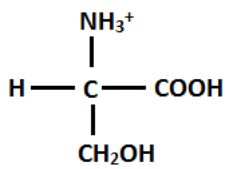
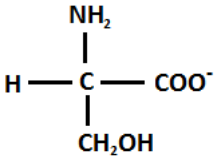
Question Number	Acceptable Answers	Reject	Mark
21(c)(i)	$Cr^{3+}(aq) + \mathbf{8}OH^- \rightarrow CrO_4^{2-} + 4H_2O + 3e^-$ IGNORE State symbols	$Cr^{3+}(aq) + \mathbf{4}OH^- \rightarrow CrO_4^{2-} + 4H^+ + 3e^-$	**(1)**

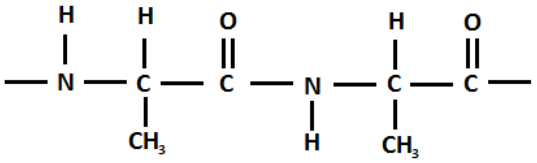
Question Number	Acceptable Answers	Reject	Mark
21(c)(ii)	$\mathbf{2}Cr^{3+}(aq) + \mathbf{10}\ OH^- + \mathbf{3}H_2O_2 \rightarrow \mathbf{2}CrO_4^{2-} + \mathbf{8}H_2O$ ALLOW TE on equation in (c)(i) using $4OH^-$: $2Cr^{3+}(aq) + 2\ OH^- + 3H_2O_2 \rightarrow 2CrO_4^{2-} + 8H^+$		**(1)**

Question Number	Acceptable Answers	Reject	Mark
21(d)	$2CrO_4^{2-} + 2H^+ \rightarrow Cr_2O_7^{2-} + H_2O$		**(1)**

(Total for Question 21 = 20 marks)

Question Number	Acceptable Answers	Reject	Mark
22(a)	Both a negative and a positive charge are present (in a neutral molecule) OR Both COO^- and NH_3^+ are present ALLOW "Ion with extra H^+ on amine group and one less H^+ on carboxyl O" Formula showing the correct charges	Just "pole" or "region" for charge Just an ion that acts as an acid or a base	**(1)**

Question Number	Acceptable Answers	Reject	Mark
22(b)	 pH 1.0  pH 10.0 Ion at pH 1.0: with NH_3^+ **(1)** Ion at pH 10.0 with COO^- **(1)**	Charge on – CH_2OH group	**(2)**

Question Number	Acceptable Answers	Reject	Mark
22(c)	 CONH displayed **(1)** Rest of molecule with extension bonds from C and N ALLOW 3 complete units Brackets round units and n following **(1)**	Ester link partial repeat units	**(2)**

Question Number	Acceptable Answers	Reject	Mark
22(d)(i)	They rotate (the plane of polarization) of (plane-)polarised light OR They are optically active OR they have a chiral centre/ they are chiral/they have a chiral carbon/ they have optical isomers / they form enantiomers		**(1)**

Question Number	Acceptable Answers	Reject	Mark
22(d)(ii)	Esterification **(1)** IGNORE condensation Neutralization/ salt formation /acid-base / protonation **(1)**	Trans-esterification	**(2)**

Question Number	Acceptable Answers	Reject	Mark
22(d)(iii)	Ethanol/ C_2H_5OH If name **and** formula are given **both** must be correct		**(1)**

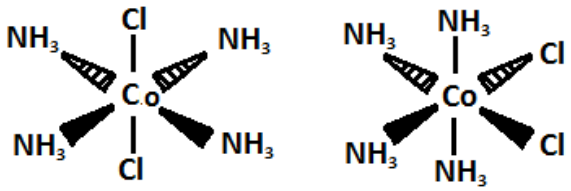
Question Number	Acceptable Answers	Reject	Mark
22(d)(iv)	Hydrolysis Acid hydrolysis	Extra answers	**(1)**

Question Number	Acceptable Answers	Reject	Mark
22(d)(v)	Carbon dioxide/ CO_2 ALLOW H_2CO_3 **(1)** ammonium chloride/ NH_4Cl ALLOW Ammonia/ NH_3 **(1)** ALLOW Aminomethanoic acid / H_2NCOOH (max 1)		**(2)**

(Total for Question 22 = 12 marks)

Question Number	Acceptable Answers	Reject	Mark
***23(a)**	Transition metals have empty /partially filled d-orbitals (of suitable energy level) OR Group 1 metals such as Na do not have empty / partially filled d-orbitals (of suitable energy level) **(1)** Which can accept pairs of electrons (from ligands) OR Ligands can form dative covalent bonds into these (d) orbitals (into these empty orbitals) **(1)**		**(2)**

Question Number	Acceptable Answers	Reject	Mark
23(b)(i)	Ionic **and** dative covalent / co-ordinate ALLOW Ionic and dative	London forces	**(1)**

Question Number	Acceptable Answers	Reject	Mark
23(b)(ii)	Geometric ALLOW cis-trans (isomers) / *E-Z* (isomers) **(1)** The 2 Cl ligands may be beside each other or opposite each other / The Cl-Co-Cl bond angle may be 90 or 180°. ALLOW diagrams **(1)**  IGNORE Lack of charge Second mark is independent of first	Diagrams not looking at all 3D	**(2)**

Question Number	Acceptable Answers	Reject	Mark
23(c)	$[Cu(H_2O)_6]^{2+} + 4Cl^- \rightarrow CuCl_4^{2-} + 6H_2O$ **(1)** Ignore state symbols even if incorrect. $[Cu(H_2O)_6]^{2+}$ Octahedral ALLOW Bi-pyramidal if accompanied by a diagram **(1)** $CuCl_4^{2-}$ Tetrahedral ALLOW Square planar **(1)**	planar	**(3)**

Question Number	Acceptable Answers	Reject	Mark
23(d)(i)	Monodentate ligands use one lone pair in bonding OR Donate one pair of electrons (to the central ion) OR Form one dative covalent bond **(1)** Hexadentate ligands donate six lone pairs of electrons from (six different atoms in) the same molecule/ ion/ (to the central ion) OR Donate six pairs of electrons (to the central ion) OR Form six dative covalent bonds **(1)**	Just "have" one lone pair	**(2)**

Question Number	Acceptable Answers	Reject	Mark
***23(d)(ii)**	2 moles of reactants go to 7 moles of products/ there is a **large** increase in the number of particles (going from left to right) **(1)** This means $\Delta S_{(system)}$ is larg**er**/ **more** positive / high**er** (so reaction more likely to have a positive ΔS_{total} and larger Kc) **(1)**		**(2)**

Question Number	Acceptable Answers	Reject	Mark
23(e)(i)	(0.22 x 100/ 2.00) = **11**(%) IGNORE sf except 1sf		**(1)**

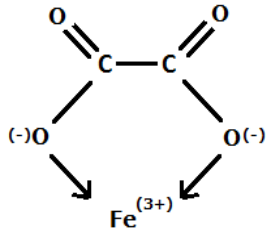
Question Number	Acceptable Answers	Reject	Mark
23(e)(ii)	Mol MnO_4^- = (36.60 x 0.0100/1000) = **3.66×10^{-4}** **(1)** Mol ethanedioate reacting = (3.66×10^{-4} x 5 /2) = **9.15×10^{-4}** **(1)** Mass ethanedioate = (9.15×10^{-4} x 88) = **0.0805 g** **(1)** % ethanedioate = (0.0805/ 0.150 x 100) = **53.68** **(1)** IGNORE sf except 1sf		**(4)**

Question Number	Acceptable Answers	Reject	Mark
23(e)(iii)	Because ethanedioate reacts with manganate((VII)) ions		**(1)**

Question Number	Acceptable Answers	Reject	Mark
23(e)(iv)	<table><tr><th>species</th><th>Percentage by mass</th></tr><tr><td>water</td><td>11</td></tr><tr><td>ethanedioate</td><td>53.68</td></tr><tr><td>iron</td><td>11.4</td></tr><tr><td>potassium</td><td>**23.92**</td></tr></table> TE on % for water and ethanedioate as long as some attempt made in (e)(ii) Ignore sf except 1 sf		**(1)**

Question Number	Acceptable Answers	Reject	Mark
23(e)(v)	<table><tr><th>Species</th><th>Number of moles in 100 g</th><th>Mole ratio</th></tr><tr><td>water</td><td>0.611</td><td>3</td></tr><tr><td>ethanedioate ions</td><td>0.61</td><td>3</td></tr><tr><td>iron</td><td>0.204</td><td>1</td></tr><tr><td>potassium</td><td>0.61</td><td>3</td></tr></table> Number of moles and ratio for water and iron **(1)** Number of moles and ratio for ethanedioate and potassium **(1)** TE on (e)(iv) Ethanedioate = (e)(iv) value /88 Potassium = (e)(iv) value /39		**(2)**

Question Number	Acceptable Answers	Reject	Mark
23(e)(vi)	$[Fe(C_2O_4)_3]^{3-}$ ALLOW $[Fe(C_2O_4)_3(H_2O)_3]^{3-}$		**(1)**

Question Number	Acceptable Answers	Reject	Mark
23(e)(vii)	 Two bonds shown, one from each COO^- ALLOW Lines instead of dative covalent arrows OR Delocalised structure shown with bonds from O at each end of the ion.		**(1)**

(Total for Question 23 = 23 marks)
Total for Section C = 70 MARKS

TOTAL FOR PAPER = 90 MARKS

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