OCR

RECOGNISING ACHIEVEMENT

TRENDS + PATTERNS

Mark Scheme 2815/01
January 2002

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme. You are advised to destroy all draft versions.

2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.

3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

x	=	incorrect response (errors may also be underlined)
^	=	omission mark
bod	=	benefit of the doubt (where professional judgement has been used)
ecf	=	error carried forward (in consequential marking)
con	=	contradiction (in cases where candidates contradict themselves in the same response)
sf	=	error in the number of significant figures

4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Abbreviations, annotations and conventions used in the Mark Scheme	/	= alternative and acceptable answers for the same marking point
	;	= separates marking points
	NOT	= answers which are not worthy of credit
	( )	= words which are not essential to gain credit
	___	= (*underlining*) key words which ***must*** be used to gain credit
	ecf	= error carried forward
	AW	= alternative wording
	ora	= or reverse argument

Question		Expected Answers	Marks
1	(a)	both atomisation steps	1
		1st and 2nd ionisation enthalpies	1
		electron affinity step	1
		lattice enthalpy	1
		enthalpy of formation	1
		all to be chemically correct and correctly labelled; penalise state symbols once only	
	(b)	$\Delta H_f = (+148) + (2\times122) + (738) + (1451) + (2\times -349) + (-2526)$	1
		ΔH_f = -643 kJ mol^{-1} *(with units ; correct answer = 2 marks)*	1
		allow ecf from (a)	
	(c)	$MgCl_2$	1
		Cl^- is the smallest anion *(reject chlorine ion)*	1
		strongest attraction / bonding	1
		[Total: 10]	
2	(a)	$1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 3d^5$	1
	(b) (i)	energy of the d electrons approximately the same / transfer energy easily / adsorb well / hold reactants in place / variable oxidation state / easily transfer electrons / good bonding potential *not "cheap"*	1
	(b) (ii)	in the Haber process / $FeCl_3$ in Friedel Crafts	1
	(c)	from yellow to (blood) red	2
		$[Fe(H_2O)_6]^{3+} + SCN^- \rightarrow [Fe(H_2O)_5SCN]^{2+} + H_2O$ *2 marks for correct equation* *allow one mark for correct formula and charge on complex ion*	2
	(d) (i)	from colourless / pale green (*NOT 'green'*) to pink/purple	1
	(ii)	no. mol Fe^{2+} = 25/1000 × 0.05 (= 0.00125 mol)	1
		no. mol MnO_4^- = 0.00125 / 5 (= 0.00025 mol)	1
		concn MnO_4^- = 0.00025 / (12.3×10^{-3}) = 0.02(03) mol dm^{-3} *allow ecf from line 2; correct answer with units = 3 marks*	1
		[Total: 11]	

Question	Expected Answers	Marks
3 (a)	(very) high mp / strong lattice / large ΔH_{latt} / does not decompose on heating	1
(b)	$MgO(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2O(l)$ *one mark for the equation* *one mark for state symbols in correct equation*	2
(c)	MgO pH = 8-12	1
	$MgCl_2$ pH = 4-7	1
(d)	*bonding* ionic	1
	structure giant / lattice	1
(e)	Mg^{2+} has greater charge density than Ca^{2+}	1
	so distorts the anion more / polarises the anion more	1
	[Total: 9]	
4 (a)	purple / violet / red	1
	absorption is in green / blue (*as appropriate*)	1
(b)	*complex ion* metal atom or ion surrounded by ligands	1
	ligand a species able to donate a pair of electrons / form a dative/co-ordinate bond	1
	ligand substitution exchange of ligands	1
	example + colour change + equation	3×2
	e.g.: $[Cu(H_2O)_6]^{2+} + 4NH_3 \rightleftharpoons [Cu(H_2O)_2(NH_3)_4]^{2+} + 4H_2O$ blue dark blue	
	$[Cu(H_2O)_6]^{2+} + 4Cl^- \rightleftharpoons [CuCl_4]^{2-} + 6H_2O$ blue yellow/green	
	octahedral + example $[Cu(H_2O)_2(NH_3)_4]^{2+}$	2
	tetrahedral + example $[CuCl_4]^{2-}$	2
	square planar + example $[PtCl_4]^{2-}$	
	linear + example $[Ag(NH_3)_2]^+$	
		Max 12
	QWC, organisation of response	1
	[Total: 15]	