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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Chemistry 5421

CHM2 Foundation Physical and Inorganic Chemistry

Mark Scheme

2007 Examination – January series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Dr Michael Cresswell Director General

1	a		Heat Energy change	1
			at constant pressure	1
	b		$N_2(g) + ½ O_2(g) \rightarrow N_2O(g)$	1
	c	i	ΔH = Σ bonds broken - Σ bonds made	1
			½ (945) + 3/2 (159) – 3(278)	1
			– 123 kJmol $^{-1}$	1
			+ 123 kJmol $^{-1}$ scores 1 mark	
			Accept no units	
		ii	The N-F bond energy is an average taken from several compounds	1
	d	i	It is an element	1
		ii	ΔH = Σ ΔH_f products - Σ ΔH_f reactants (or correct cycle)	1
			–114 + 3(–467) – 4(–46) – 0	1
			– 1331 kJmol $^{-1}$	1
			+1331 kJmol $^{-1}$ scores 1 mark	
			Accept no units	
2	a	i	+1	1
			0	1
			+5	1
		ii	HClO is simultaneously oxidised and reduced	1
	b	i	$2HClO + 2H^+ + 2e^- \rightarrow Cl_2 + 2H_2O$	1
			or $2ClO^- + 4H^+ + 2e^- \rightarrow Cl_2 + 2H_2O$	
		ii	$HClO + 2H_2O \rightarrow ClO_3^- + 5H^+ + 4e^-$	1
			or $ClO^- + 2H_2O \rightarrow ClO_3^- + 4H^+ + 4e^-$	
3	a	i	Decreases from fluorine to iodine	1
		ii	$Cl_2 + 2KBr \rightarrow Br_2 + 2KCl$	1
			Accept ionic equations	
	b		J NaF, accept F^- or correct name.	1
			K NaI, accept I^- or correct name.	1
			L NaBr, accept Br^- or correct name.	1
			M Br_2 / bromine	1
			N and Q HBr /hydrogen bromide	1
			SO_2 /sulphur dioxide	1

4	a		Rate of the forward reaction = rate of the backward reaction	1
			Concentrations are constant	1
	b		Increase	1
			There are 3 moles on the LHS and 2 moles on the RHS	1
			so the system moves to the right to decrease the pressure/ oppose the increase in pressure	1
	c		Negative allow exothermic	1
			the equilibrium shifts to decrease the temperature/ oppose the increase in temperature	1
5	a		Resists corrosion } any two	1
			Abundant ore } any two	1
			Lightweight } any two	
	b	i	Molten or dissolved	1
			in cryolite	1
			$Al^{3+} + 3e^- \rightarrow Al$	1
			$2O_2^- \rightarrow O_2 + 4e^-$	1
		ii	Reduction	1
	c		$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$	1
			Reducing agent	1
	d		$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$	1
			or $Fe_2O_3 + 3C \rightarrow 2Fe + 3CO$	
			or $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$	
			1500 C (or in range 1-2000C)	1
			accept high temperatures	
	e		Blast furnace process is continuous	1
			Coke/ CO is a cheaper reducing agent than Aluminium QoL	1

6	a	Y axis labelled as number/ fraction/ % of molecules X axis labelled energy Both axes must be correctly labelled for 1 mark	1
		Curve starts at origin	1
		Curve skewed to the left and has a decreasing gradient to a maximum	1
		Curve after maximum decreases in steepness, never touches x axis, levels out at <10% of the maximum height	1
		W is displaced to the right	1
		and is flatter/ lower	1
	b	The change in concentration per unit of time QoL	1
		Both axes must be labelled to gain marks for graph. y axis conc NO_2 and x axis time	
		Curve starts at origin	1
		and levels off	1
		If candidates graph does not level off then second mark can be scored for a curve with a continuously decreasing gradient.	
		Initial rate can be found by finding the gradient at t = 0	1
		Candidates may score this mark if they have shown this on their graph	
	c	$2SO_2 + O_2 \rightarrow 2SO_3$	1
		accept multiples	
		NO is a catalyst	1
		it is regenerated at the end of the reaction	1
		provides an alternative route	1
		of lower activation energy	1