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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

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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	$\Delta H = \Sigma \Delta H_f$ products - $\Sigma \Delta H_f$ 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 <u>change in concentration</u> 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