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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Chemistry (5421)

CHM2 Foundation Physical and Inorganic Chemistry

Mark Scheme

2008 examination - January series

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Question 1

(a)	(i)	Cream/off white ppt	1
		$Ag^+ + Br^- \rightarrow AgBr$	1
	(ii)	Precipitate dissolves/ colourless solution formed	1
(b)	(i)	Yellow/orange/brown solution forms	1
		$Cl_2 + 2Br^- \rightarrow 2Cl^- + Br_2$	1
	(ii)	F^- / fluoride ion	1
		Cl_2 less reactive than F_2 / Cl_2 weaker oxidising agent than F_2	1
		F^- worse reducing agent than Cl^-	
(c)		$2NaOH + Br_2 \rightarrow \underbrace{NaBr + NaOBr}_{\text{1 mark}} + H_2O$	2
		1 mark for balanced equation	

Total 9

Question 2

(a)	Increase	1
	Reaction is exothermic	1
	System tries to raise temperature of system/ opposes the change	1
(b)	No effect	1
	Same no of moles on each side / each side affected equally	1
(c)	System tries to lower concentration of hydrogen (and moves the right)	1
(d)	Increases the rate of the forward and backward reactions	1
	Equally	1

Total 8

Question 3

(a)	Enthalpy change when 1 mole of compound	1
	Is completely burned in oxygen	1
	Under standard conditions	1
(b)	$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$	1
(c)	$\Delta H = \Sigma \Delta H_f$ products $- \Sigma \Delta H_f$ reactants (or correct cycle)	1
	$(-393 \times 3) + (-286 \times 4) - (-315)$	1
	-2011 kJmol^{-1}	1
	(+ 2011 kJmol^{-1} scores 1 mark)	
(d)	Less negative (QWC)	1

(e) $Q = mc\Delta T$ 1
$250 \times 4.2 \times 16 = 16800$ J 1

Moles propanol = 0.92/60 (= 0.0153) 1
ΔH_c = 16800/0.0153
-1096 kJmol^{-1} 1
(allow answers in range -1090 to -1120)

(f) Heat loss occurs in (e)/ no heat loss in (c) / incomplete combustion in (e) 1

Total 13

Question 4

(a) Curve lower and skewed to fight 1
Starts at origin and does not touch x axis or cross drawn curve on right 1

(b) Peak height in same place as drawn curve 1
Peak height twice as high as drawn curve 1

(c) (i) Particles **A** and **B** may not have the activation energy required for a successful collision 1

(ii) Increasing temperature by a small amount increases the number of particles having $E \geq E_a$ 1
Increasing pressure by a small amount increases collisions by a small amount (QWC) 1

(d) Provides an alternative route 1
of lower activation energy 1

Total 9

Question 5

(a) (+) 4 1
(+) 6 1

(b) (i) $Cl_2 + 2e^- \rightarrow 2Cl^-$ 1

(ii) $H_2O + SO_3^{2-} \rightarrow SO_4^{2-} + 2H^+ + 2e^-$ 1

(iii) $Cl_2 + H_2O + SO_3^{2-} \rightarrow SO_4^{2-} + 2H^+ + 2Cl^-$ 1

(iv) Reducing agent 1

Total 6

Question 6

(a)	Sulphur removed using Mg (or Ca)	1
	$Mg + S \rightarrow MgS$	1
	C removed by blasting with <u>oxygen</u>	1
	$C + O_2 \rightarrow CO_2$	1
	Or $C + ½ O_2 \rightarrow CO$	
	P removed by blowing <u>oxygen</u> into the (molten) iron	1
	$4P + 5O_2 \rightarrow P_4O_{10}$	1
	<u>CaO</u> added (which combines with the phosphorus oxide) calcium	1
	phosphate is made / slag is made	1
	(Or $6CaO + P_4O_{10} \rightarrow 2Ca_3(PO_4)_2$ scores the last 2 marks)	
	Otherwise SO_2 formed (which causes acid rain)/ Fe oxidised in preference to S	1
(b)	C not used to extract Ti since TiC formed	1
	Makes the Ti brittle	1
(c)	<u>Electricity</u> used for electrolysis is expensive	1
	C not reactive enough/	1
	C not used to extract Al since the temperature needed would be too high/	
	Al_2O_3 very stable	
	$Al^{3+} + 3e^- \rightarrow Al$	1
	$2O^{2-} \rightarrow O_2 + 4e^-$	1

Total 15