AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Chemistry (5421)

CHM2   Foundation Physical and Inorganic Chemistry

Mark Scheme

2008 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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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) $2NaOH + Br_2 \rightarrow \underbrace{NaBr + NaOBr} + H_2O$ 2
                           1 mark
                           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 = mcΔT	1
	250 x 4.2 x 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 |

(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 $C + \frac{1}{2} O_2 \rightarrow CO$

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 1
preference to S

(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