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GCE O Level Chemistry (7081)

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CHEMISTRY 7081, MARK SCHEME

Paper 1

1	(a)	(i)	$CuBr_2$	**(1)**
		(ii)	Al_2O_3	**(1)**
		(iii)	$(NH_4)_2SO_4$	**(1)**
	(b)	(i)	Ca^{2+}	**(1)**
		(ii)	OH^-	**(1)**
		(iii)	Br^-	**(1)**
		(iv)	SO_4^{2-}	**(1)**
		(v)	OH^-	**(1)**
		(vi)	NH_4^+	**(1)**

(Total 9 marks)

2	(a)	2,8,5	**(1)**
	(b)	2,8,8	**(1)**
	(c)	143	**(1)**
	(d)	18	**(1)**
	(e)	96 dm^3/96000 cm^3	**(1)**

(Total 5 marks)

3	(a)	nitrogen	**(1)**
	(b)	iodine	**(1)**
	(c)	any noble gas	**(1)**
	(d)	anhydrous copper sulphate	**(1)**
	(e)	any strong acid	**(1)**
	(f)	NH_3 (accept SO_3)	**(1)**

(Total 6 marks)

4	(a)	giant	**(1)**
		positive	**(1)**
		delocalised	**(1)**
		electrons	**(1)**
	(b)	increases	**(1)**
		electron shells	**(1)**
		increases	**(1)**

(Total 7 marks)

5	(a)	(i)	0.5L (or 3 x 10^{23})	**(1)**
		(ii)	5L or 3 x 10^{24} or 30 x 10^{23})	**(1)**
		(iii)	4L (or 2.4 x 10^{24})	**(1)**
		(iv)	2L (or 1.2 x 10^{24})	**(1)**
	(b)	M_r (NH_4NO_3) = 80		**(1)**
		% = 28/80 x 100 (mark is for 28/80)		**(1)**
		35%		**(1)**
				(Total 7 marks)
6	(a)	potassium + water → potassium hydroxide + hydrogen		**(1)**
	(b)	lithium carbonate → lithium oxide + carbon dioxide		**(1)**
	(c)	zinc + copper nitrate → zinc nitrate + copper		**(1)**
	(d)	chromium oxide + aluminium → aluminium oxide + chromium		**(1)**
	(e)	sodium nitrate → sodium nitrite + oxygen		**(1)**
				(Total 5 marks)
7	(a)	cryolite		**(1)**
	(b)	carbon/graphite		**(1)**
	(c)	(i)	$Al^{3+} + 3e \rightarrow Al$	**(1)**
		(ii)	$2O^{2-} - 4e \rightarrow O_2$ (if reactions reversed, allow 1 mark)	**(1)**
	(d)	carbon reacts with oxygen/ is oxidised		**(1)**
		forms CO_2/ wears away the electrode		**(1)**
		(balanced equation would score 2 marks)		
	(e)	use		**(1)**
		physical property		**(1)**
				(Total 8 marks)
8	(a)	(i)	$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$	**(1)**
			catalyst is platinum (or Pt/Rh)	**(1)**
		(ii)	$4NO + 2H_2O + 3O_2 \rightarrow 4HNO_3$	**(1)**
	(b)	(i)	brown	**(1)**
		(ii)	blue	**(1)**
				(Total 5 marks)

9	(a)	D	**(1)**
	(b)	A	**(1)**
	(c)	E	**(1)**
	(d)	C	**(1)**
	(e)	B	**(1)**
			(Total 5 marks)
10	(a)	fraction 1 – name + use fraction 2 – name + use (if both fractions correct, but uses incorrect, allow 1 mark) (allow 'cracking' and 'petrochemicals' once only)	**(1)** **(1)**
	(b)	(i) cracking /pyrolysis (ii) $C_6H_{14} \rightarrow C_3H_6 + C_3H_8$	**(1)** **(1)**
	(c)	correct structure showing bonding	**(1)**
			(Total 5 marks)
11	(a)	(ii) 300 (iii) 300 (iv) 150	**(1)** **(1)** **(1)**
	(b)	moles of acid double so volume of CO_2 doubles	**(1)**
	(c)	in (a) (iii) concentration of acid increases so more H^+ ions/more collisions in (a) (iv), smaller pieces so greater surface area greater frequency of collisions	**(1)** **(1)** **(1)** **(1)**
	(d)	reactions involve H^+ ions both strong acids/ both monoprotic/ same strength/ same pH	**(1)** **(1)**
			(Total 10 marks)
12	(a)	carbon	**(1)**
	(b)	allotropes	**(1)**
	(c)	macromolecular/ giant molecules/ giant atomic/ giant covalent strong bonds/covalent bonds have to be broken	**(1)** **(1)**
	(d)	in diamond all bonds are strong graphite has weak forces between layers layers can slide/separate	**(1)** **(1)** **(1)**

	(e)	diamond has all electrons (used in bonding)/ no spare electrons			(1)
		graphite uses only 3 electrons (in bonding)/delocalised electrons			(1)
		electrons move (and carry current)			(1)
					(Total 10 marks)
13	(a)	(i)	shared electrons correct		(1)
			other electrons correct		(1)
			covalent /double bonds		(1)
		(ii)	electron arrangements (8 and 8)		(1)
			Ca^{2+} and O^{2-}		(1)
	(b)	(i)	water – V-shaped		(1)
		(ii)	ammonia – pyramidal		(1)
	(c)	structural formula 1			(1)
		structural formula 2			(1)
					(Total 9 marks)
14	(a)	(i)	bond breaking:	410 + 240 or (4 x 410) + 240	(1)
				650 kJ or 1880 kJ	(1)
		(ii)	energy released:	340 + 430 or (3 x 410) + 340 + 430	(1)
				770 kJ or 2000 kJ	(1)
		(iii)	ΔH = -120 kJ value = 120		(1)
			correct sign		(1)
	(b)	F-F bond easier to break than Cl-Cl bond			(1)
		more energy released on formation of C-F than C-Cl/ more energy released when fluorine reacts with methane			(1)
	(c)	Si-Si bond is too weak / weaker than C-C / C-C bonds stronger than Si-Si			(1)
					(Total 9 marks)

TOTAL FOR PAPER: 100 MARKS

Paper 2

1	(a)	correct plot: 5 points correct = 2; 3 (or 4) points correct = 1		(2)
		straight line through points		(1)
	(b)	(i)	line extrapolated correctly	(1)
			0.220 – 0.222g / from graph ± 0.002	(1)
		(ii)	mass = 44g)	(1)
			44 = M_r) ecf from (i)	(1)
	(c)	(i)	turns lime water 'milky'	(1)
		(ii)	correct name/formula	(1)
			balanced equation	(1)
				(Total 10 marks)

2	(a)	(i)	similarity; same number of protons/electrons	**(1)**
			difference: different number of neutrons	**(1)**
		(ii)	same electron arrangement/one electron (in outer shell)	**(1)**
	(b)	$H_2 + Cl_2 \rightarrow 2HCl$		**(1)**
	(c)	(i)	3 shared pairs	**(1)**
			other electrons correct (only if 1st mark awarded)	**(1)**
		(ii)	$AlCl_3$: weak intermolecular attractions/van der Waals forces	**(1)**
			Al_2O_3: oppositely charged ions	**(1)**
			strong attraction between ions	**(1)**
			reference to energy needed to separate particles/ break bonds (must be in context)	**(1)**
			(any reference to weak covalent bonds can score marks 2 and 3 only)	

(Total 10 marks)

3	(a)	expt 1: no rust	**(1)**
		no air /oxygen present	**(1)**
		expt 2: rusts	**(1)**
		water and air/oxygen present	**(1)**
		expt 3: no rust	**(1)**
		no water / moisture present No mark if state no O_2 as well	**(1)**
	(b)	add aqueous ammonia / sodium hydroxide <u>solution</u>	**(1)**
		brown <u>ppt</u> (red-brown okay but not red)	**(1)**
	(c)	Mg above Fe in reactivity series/more reactive	**(1)**
		corrodes/reacts in preference to iron/steel / reacts first / sacrificial protection (do not allow magnesium rusts)	**(1)**

(Total 10 marks)

4	(a)	(i)	ethene + water or steam (can be scored in the equation)	**(1)**
			heat / 250 – 500 °C / high temperature	**(1)**
			elevated pressure / 40-100 atm	**(1)**
			(phosphoric) acid catalyst	**(1)**
			equation (accept condensed structural formulae)	**(1)**
		(ii)	advantage eg fast(er), purer product, continuous, etc.) not cost or heat	**(1)**
			disadvantage eg non-renewable source)	**(1)**
	(b)	(i)	minimum is $-(CH_2)_4COOCH_2CH_2-$	**(1)**
		(ii)	condensation polymerisation	**(1)**
		(iii)	loss/ formation of small molecule / water / only one monomer in poly(ethene)	**(1)**
			Accept comments on use of C=C to build chain in addition polymers	

(Total 10 marks)

5 (a) known weight of tin oxide **(1)**
use of a reduction tube or similar **(1)**
pass hydrogen through to expel air **(1)**
heat tin oxide whilst passing hydrogen over it **(1)**
ignite excess gas **(1)**
heat until all oxide changes to metal (or heat to constant mass) **(1)**
cool with gas still passing **(1)**
reweigh/ find mass of tin **(1)**

(Maximum 6 marks)

(b) (i) mass of oxygen = 0.64g **(1)**
(ii) 2.38 /119 : 0.64 / 16 **(1)**
0.02 : 0.04 (or 1: 2 appreciated) **(1)**
formula is SnO_2 **(1)**
(some working must be shown for 3 marks; formula only = 1 mark)

(Total 10 marks)

6 (a) (i) concentrated HCl **(1)**
manganese (IV) oxide /MnO_2 + heat **(1)**
or potassium manganate(VII) /$KMnO_4$ (at r.t. not required)
(credit bleaching powder if chemistry correct)
suitable generator eg flask with funnel, etc **(1)**
wash with water to remove HCl **(1)**
dry using concentrated H_2SO_4 **(1)**
collect by downward delivery/ syringe **(1)**
(award marks for diagram or statement)
equation – correct formulae **(1)**
balance **(1)**
Allow 1 mark for $2HCl + O \rightarrow Cl_2 + H_2O$
Poor diagram loses 1 mark

(ii) bleaches named indicator paper **(1)**
(ammonia → white fumes)
(iii) eg colour darkens / green → brown → black **(1)**
m.pt or b.pt increases / gas → liquid → solid **(1)** **(any 2)**
solubility (in water) decreases **(1)**

(11 marks)

(b) red-brown solution **or** dark grey/ black pot **(1)**
balanced equation – ionic or full formulae (ignore spectator ions) **(1)**
chlorine gains electrons / correct half-equation **(1)**
iodide loses electrons /correct half-equation **(1)**
chlorine is oxidising agent **(1)**

If KBr used allow maximum last 3 marks **(5 marks)**

(c) (i) iron(III) chloride (1)
$2Fe + 3Cl_2 \rightarrow 2FeCl_3$ (1)

(ii) less vigorously (not slowly) / similar reaction /black solid formed (1)
iron (III) bromide (1)

(iii) reactivity decreases (1)
atoms get bigger / more electron shells (1)
less attraction for an extra electron (1)

(iv) iron(II) chloride (1)
$Fe + 2HCl \rightarrow FeCl_2 + H_2$ (1)

(9 marks)

(Total 25 marks)

7 Accept names or formulae for identification.

(a) gas is sulphur dioxide (1)
A is a sulphite (1)
(lilac colour indicates) potassium (1)
$K_2SO_3 + 2HCl \rightarrow 2KCl + SO_2 + H_2O$ **or** ionic (1)

(4 marks)

(b) **B** contains copper (1)
shown by blue solution /brown deposit (1)
$Mg + Cu^{2+} \rightarrow Mg^{2+} + Cu$ **or** full formulae (1)
White ppt is silver chloride / identified in equation (1)
Chloride is present (1)
$Ag^+ + Cl^- \rightarrow AgCl$ **or** full formulae (1)

(6 marks)

(c) bromine decolourised, hence alkene/unsaturated (1)
3 moles of CO_2, therefore 3 carbon atoms and/or
3 moles of H_2O, therefore 6 hydrogen atoms (1)
C is propene / C_3H_6 (2)
$C_3H_6 + 4½O2 \rightarrow 3CO_2 + 3H_2O$ (1)
$CH_3CH{=}CH_2 + Br_2 \rightarrow CH_3CHBrCH_2Br$
/ $C_3H_6 + Br_2 \rightarrow C_3H_6Br_2$ (1)

If ethene, maximum 3 (1st and last 2 marks) **(6 marks)**

(d) **D** is calcium (1)
gas is hydrogen (1)
blue litmus colour shows alkali formed (1)
calcium hydroxide (1)
$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$ / $2H_2 + O_2 \rightarrow 2H_2O$ (1)
(allow 3 maximum if metal said to be Li, Na, K or Mg)

(5 marks)

	(e)	**E** is ethanol		**(1)**
		steamy fumes are HCl / signifies the OH group is present		**(1)**
		F is chloroethane		**(1)**
		$C_2H_5OH + PCl_5 \rightarrow C_2H_5Cl + POCl_3 + HCl$		**(1)**
				(4 marks)
				(Total 25 marks)
8	(a)	(i)	NaOH in burette	**(1)**
			read volume at start	**(1)**
			measured / number eg 25cm^3 H_2SO_4 by pipette	
			(into flask or similar)	**(1)**
			a few drops of indicator	**(1)**
			run in NaOH from burette and swirl	**(1)**
			dropwise near end-point	**(1)**
			pink at end-point	**(1)**
			read burette	**(1)**
			repeat titration to obtain concordant results	**(1)**
			(acid and alkali can be reversed)	
				(9 marks)
		(ii)	**either** moles NaOH = 0.50 x 0.0265 = 0.01325	**(1)**
			moles H_2SO_4 = 0.006625	**(1)**
			concentration H_2SO_4 = 0.00625 / 0.025 = 0.265 mol dm^{-3} ecf	**(1)**
			or $M_1 \times V_1 / n_1 = M_2 \times V_2 / n_2$	**(1)**
			$M_1 \times 25 = 0.50 \times 26.5 / 2$	**(1)**
			M_1 = 0.265 mol dm^{-3} ecf	**(1)**
				(3 marks)
		(iii)	mix 26.5 cm^3 NaOH and 25 cm^3 H_2SO_4	**(1)**
			no indicator	**(1)**
			partially evaporate by heating /leave in the sun etc	**(1)**
			method of drying that does no involve loss of w. of c.	**(1)**
				(4 marks)
	(b)	mass of anhydrous salt = 2.84g		**(1)**
		Mr (Na_2SO_4) = 142		**(1)**
		Mole ratio 2.84 /142 : 3.60 /18		**(1)**
		0.02 : 0.1, hence x =10		**(1)**
		(answer without any working = 1 mark only)		
				(4 marks)
	(c)	(i)	enthalpy change = -56 (kJ mol^{-1}) (ignore sign at this stage)	**(1)**
			$H^+ + OH^- \rightarrow H_2O$	**(1)**
			bonds formed so energy released	**(1)**
		(ii)	reactants and products correctly positioned	**(1)**
			ΔH correctly shown (independent of first mark)	**(1)**
				(5 marks)
				(Total 25 marks)

9	(a)	(i)	(forward) reaction is endothermic	**(1)**
			(205kJ of) heat energy is absorbed	**(1)**
			Accept comments or diagrams on bond breaking more energy than bond making for either mark	
		(ii)	reaction 2 – it is exothermic	**(1)**
			slow reaction) independent of 1st mark	**(1)**
			use a catalyst)	**(1)**
		(iii)	reaction 2 – decrease in moles/volume when product formed	**(1)**
			expense /danger independent of 1st mark	**(1)**

(7 marks)

(b)	Haber Process	**(1)**
	$N_2 + 3H_2 \rightleftharpoons 2NH_3$	**(1)**
	350 – 550 °C	**(1)**
	150 – 350 atmos	**(1)**
	iron catalyst	**(1)**

(5 marks)

(c)	(i)	ammonium sulphate	**(1)**
		dilute acid + ammonia	**(1)**
		acid neutralises ammonia	**(1)**
		$H_2SO_4 + 2NH_3 \rightarrow (NH_4)_2 SO_4$	**(1)**
		(allow NH_4OH for ammonia)	
		(accept preparations of potassium sulphate or magnesium sulphate)	
	(ii)	eg ethyl ethanoate	**(1)**
		ethanol + ethanoic acid	**(1)**
		concentrated H_2SO_4	**(1)**
		acts as catalyst	**(1)**
		$C_2H_5OH + CH_3COOH \rightarrow CH_3COOC_2H_5 + H_2O$	**(1)**

(9 marks)

(d) any **two** gases and associated problems

sulphur dioxide / SO_2	**(1)**
acid rain (or effects of)	**(1)**
oxides of nitrogen	**(1)**
acid rain (or effects of)	**(1)**
carbon monoxide	**(1)**
toxic (or effect on blood)	**(1)**

(if 'acid rain' given twice, insist on an effect of acid rain for the 4th mark)

(Maximum 4 marks)

(Total 25 marks)

TOTAL FOR PAPER: 100 MARKS

CHEMISTRY 7081, CHIEF EXAMINER'S REPORT

General Comments

Paper 1

Question 1

(a) This was mainly correct although some candidates simply copied out the ions rather than combining them into a normal formula. Ion charges should not be left in the formulae of compounds, but this was not penalised.

(b) Often well done, but a common error was to write NH_4^+ as the answer to part (ii).

Question 2

Some candidates did not read part (b) carefully and gave an answer 2,8,8,1 but the remaining parts were often correct. A correct unit was required in part (e).

Question 3

(b) Incorrect responses included 'graphite' and 'potassium manganate(VII)'.

(c) 'Monatomic' was either not understood or was ignored by many candidates as answers included both CO and CO_2.

(d) 'Anhydrous' was required.

(e) 'Acid' was insufficient; a correct name or formula of a specific acid was required.

(f) 'CH_4' was a common incorrect response, candidates reasoning that the carbon atom was attached to four other atoms.

Question 4

Despite the instruction to choose words from the given list, some candidates selected unlisted ones. In part (a), there were many completely correct answers but others indicated great confusion about the structure of a metal. The frequent error in part (b) was to write 'electrons' instead of 'electron shells'.

Question 5

A number of candidates ignored the example given in the introduction and did not include 'L' in their answers or they wrote the answer in terms of 6×10^{23}. It was common for candidates to forget that hydrogen gas has M_r of 2 and that sulphuric acid releases two hydrogen ions, and therefore arrive at incorrect answers 10L in part (ii) and 2L in part (iii). The calculation in part (b) was usually correct but some could not calculate the M_r.

Question 6

Since an example was given to show what was required, formula equations were awarded no marks. Common errors were 'hydrogen' missing in part (a), 'no decomposition' stated for part (b) and 'nitrogen dioxide' included in part (e).

Question 7

Parts (a), (b) and (c)(i) were well done but in part (c)(ii) equations involving hydroxide ions were common. Part (d) was satisfactory but some did not make it clear that oxygen reacts with the carbon electrode. In part (e), some did not link the property correctly to the use and some gave a chemical property such as 'does not corrode'.

Question 8
The equations were often correctly balanced and the catalyst was correctly named but there were many mistakes in part (b), the most frequent being 'colourless' gas and 'brown' or 'green' solution.

Question 9
This question was very well answered with no common error being noted.

Question 10
(a) The fractions were quite well known but 'natural gas' is not one of them.

(b) The process was sometimes described as 'polymerisation'. The formula of propene was not well known.

(c) This was poorly answered as many did not know the structure of the monomer and thus found it impossible to draw the structure of the polymer.

Question 11
(a) Many scripts had blanks here; others tried to use the rate to work out the volume of carbon dioxide given off instead of using the volumes and concentrations of the acid.

(b) Candidates were expected to appreciate that the number of moles of acid increases and hence the volume of gas doubles too.

(c) Most students realised that the concentration of acid increases and so the number of collisions also increases but few were exact enough to state that the frequency of collisions increases. Similarly, it should be realised that the surface area increases with smaller pieces and hence there are more collisions in a given time.

(d) To gain two marks, answers had to include the idea that the acids are both strong or both monoprotic and hence give the same concentration of H^+ ions in solution and it is these ions that are responsible for the reaction.

Question 12
Parts (a) and (b) were usually correct.

(c) A statement that the structures are macromolecular etc. was often seen but few followed this up by stating that covalent bonds have to be broken and this requires a lot of energy.

(d) Candidates did not make it clear that all the bonds in diamond are strong whereas in graphite there are weak attractive forces between the layers and this allows the layers to slide over each other. Too often there was a statement that the bonds in graphite are weaker than those in diamond without any reference to which 'bonds' were being discussed.

(e) Many candidates knew that graphite uses only three electrons in bonding whereas diamond uses all four of its outer shell electrons. Few went on to say that graphite has delocalised electrons, and the crucial idea of the movement of flow of electrons was replaced simply by the word 'free', which was not sufficient to gain credit.

Question 13

(a) Candidates did not read the question carefully enough and, as a consequence, missed out sections. Some did not put any electrons on the diagrams; this was more frequent in part (ii) than in part (i).

(b) There were many correct diagrams but some linear water molecules and some O-H-O were seen. Ammonia was often T-shaped.

(c) Most managed one structure but the second attempt was often a contorted repeat of the first.

Question 14

(a) There were many very good responses to this question. The main errors were to use 2 x 240 kJ in part (i) and to perform the subtraction in part (iii) in the reverse order and thus obtain +120 kJ mol^{-1} as the answer.

(b) Answers tended merely to restate the information given in the table without using it to explain why fluorine reacts more readily. Candidates were expected to realise that the F-F bond is easier to break than the Cl-Cl bond and that more energy is released when a C-F bond is formed than when a C-Cl bond is formed.

(b) This was similar to (b) in that the information was not used to explain that the Si-Si bond is too weak relative to the C-C bond for long chains to form. A few knowledgeable students pointed out that the Si-O bond is much stronger and this is the preferred method of combination for silicon!

Paper 2

Section A

Question 1

Candidates' ability to plot graphs was generally very good, however occasional carelessness was shown by reading scales incorrectly. This cost valuable marks.

Most candidates were able to extend the graph and to use the value obtained to calculate the mass of 24 dm^3 of the gas. Relatively few realised the significance of their answer and thus failed to state that this was the relative molecular mass of the gas.

The test for carbon dioxide proved almost universally known and most candidates were able to provide a suitable example of a carbonate that decomposed on heating.

Question 2

Candidates were specifically asked for differences in atomic structure between the isotopes of hydrogen, so answers in terms of atomic number and mass number gained no credit.

A significant number of candidates failed to balance what was a very simple equation for the reaction between hydrogen and chlorine.

Diagrams showing the arrangement of outer electrons in aluminium chloride were generally good; the commonest error being the inclusion of a pair of non-bonding electrons around the aluminium atom.

Explanations of the differing melting points of aluminium chloride and aluminium oxide were often poor and confused. There were frequent incorrect statements like 'covalent bonds are weaker than ionic bonds' with no appreciation that in aluminium chloride the 'bonding' at issue was the forces between molecules.

Question 3
The conditions required for iron to rust were very well known.

The test for iron(III) ions was surprisingly poorly known. Far too frequently, marks were thrown away for failing to provide essential detail such as sodium hydroxide **solution** and red-brown **precipitate**.

The reactivity of magnesium compared to iron was well known but often the sacrificial corrosion of magnesium was not commented on. Candidates should not use the term 'rust' to describe the corrosion of any metal other than iron.

Question 4
The production of ethanol from ethene was generally well known, but the advantages and disadvantages were less well appreciated. There were far too many vague answers relating to cost, rather than to purity, rate or other important factors.

Condensation polymerisation was well known although drawings showing the structure of the repeating unit were sometimes careless.

Question 5
The practical procedure to reduce tin oxide was generally badly answered with relatively few candidates scoring well. Candidates should have been familiar with this procedure in the context of reducing copper oxide but appeared unable to transfer the method to a different oxide.

The calculations to find the empirical formula of tin oxide were, by contrast, well done. A significant number of candidates used the symbol Ti, rather than Sn, to represent tin in the final equation.

Section B

There appeared to be no pattern in question popularity in this Section, with all questions being attempted by candidates. Marks above 20 were not common, but were occasionally seen from the very best candidates.

Question 6
The preparation of dry chlorine proved difficult for most candidates. Diagrams of the apparatus were often badly drawn. Too often important details were omitted such as: the need for **concentrated** hydrochloric acid; the need for **heat** if manganese dioxide is the oxidising agent; the gas being bubbled through water **to remove HCl** and then being bubbled through concentrated sulphuric acid **to remove water**. The question clearly asked for the use of an oxidising agent so candidates preparing chlorine via electrolysis gained no credit.

The test for chlorine gas proved to be an easier source of marks.

The question asked for ways in which the physical properties of the halogens change down the Group so comments on chemical properties gained no credit.

Explanations of what happens when chlorine is bubbled through potassium iodide solution were generally very good although observations were sometimes inaccurate.

The reactions relating to the formation of iron halides were known by most candidates, but there was some confusion between iron(II) and iron(III).

Question 7
Most candidates identified the potassium ion and the majority also identified the sulphite ion although there was some confusion between sulphite and sulphate.

Most candidates identified the copper(II) ion, but there was some confusion over the anion with the sulphate ion being a popular incorrect answer. Many candidates identified the chloride ion from the test with silver nitrate solution but failed to identify the white precipitate as silver chloride.

Most candidates identified the gas as propene but sometimes failed to provide sufficient evidence of their reasoning in reaching this conclusion. Candidates who incorrectly identified the gas as ethene were given some credit for this question.

About half of the candidates identified the metal as calcium. The remainder suggested a variety of other Group 1 and Group 2 metals for which they received partial credit.

Most candidates identified the liquid as ethanol but the product after reaction with phosphorus pentachloride was less well known. A frequent incorrect answer was dichloroethane. The equation for this reaction often caused problems.

Question 8
Details of the titration were usually reasonable but there were relatively few very good answers. Too often important details were omitted. Few candidates appeared to realise that a salt made this way would contain indicator as a coloured impurity and to make a pure sample of the salt it would be necessary to repeat the procedure using exactly the same amounts of acid and alkali.

The calculations relating to the titration and the formula of sodium sulphate were generally very well done.

Most candidates were able to make a good attempt at calculating the enthalpy change when nitric acid was neutralised by sodium hydroxide and providing an energy profile for this reaction.

Question 9
Pupils' understanding of ΔH was sometimes rather vague. They knew it was something to do with energy but were not quite sure exactly what. Answers relating to the effects of changing temperature and pressure on the reactions were very variable. Some candidates showed a thorough understanding while others did little more than guess.

The reactions and conditions for the Haber process were very well known. Some candidates lost an easy mark by failing to show the reaction as reversible.

Candidates did not fully appreciate the chemistry involved in the formation of sulphate fertilisers. Important details, like a mention of neutralisation, were too often omitted.

The formation of esters was well known.

Most candidates were able to state two pollutant gases but the suggested effects of them were sometimes too vague to obtain credit.

CHEMISTRY 7081, GRADE BOUNDARIES

Grade	A	B	C	D	E
Lowest mark for award of grade	67	54	42	37	25

Note: Grade boundaries may vary from year to year and from subject to subject, depending on the demands of the question paper.

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