External Assessment Report 2011

Subject	**Chemistry**
Level	**Standard Grade**

The statistics used in this report are pre-appeal.

This report provides information on the performance of candidates which it is hoped will be useful to teachers/lecturers in their preparation of candidates for future examinations. It is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published question papers and marking instructions for the Examination.

Comments on candidate performance

General comments

With the high cut-off for Credit knowledge and understanding and problem solving in recent examinations in mind, there was an attempt to increase the level of demand in the Credit paper.

Feedback points to a more testing paper but still one that is fair and accessible to all. This is reflected in the cut-offs for the examination.

However, at General level an attempt was made to ease the level of demand to raise the cut-off scores to the notional difficulty.

Although it is encouraging to see that the majority of candidates are giving the required number of responses in grid questions, comments suggest that, despite previous reports highlighting the issue, some candidates are circling the incorrect number of responses or failing to circle any responses.

Changes made to the assessment tool have resulted in both examinations being accessible to a large percentage of candidates with literacy difficulties as it allows them to demonstrate their chemical knowledge.

Areas in which candidates performed well

General level

Q1 (a)	Selecting information (symbol) from data booklet
Q1 (b)	Identifying an element with similar chemical properties
Q2 (a)	Speed of reaction
Q2 (b)	Fair testing
Q3 (a)	Identifying the metal used to galvanise iron
Q3 (b)	Identifying the metal which does not react with dilute acid
Q3 (c)	Selecting information (relative atomic mass) from data booklet
Q3 (d)	Identifying the metal found uncombined in the Earth's crust
Q4 (a)	Identifying cracking as the process to produce smaller, more useful hydrocarbons
Q4 (b)	Identifying electrolysis as the process used to break up a compound into its elements
Q4 (c)	Identifying polymerisation as the process used to make plastics from alkenes
Q5 (c)	Identifying gas produced during a lightning storm
Q5 (d)	Identifying the gas required for combustion to take place
Q6 (a)	Identifying the precipitate using the data booklet
Q6 (b)	Identifying that ammonium sulphate contains an essential element for plant growth
Q10 (a)	Writing a molecular formula from a diagram
Q10 (b)	Stating that a bond holds atoms together
Q11 (a)	Presenting information as a bar chart
Q12 (a)	Identifying a chemical reaction from observations
Q13 (c)	Predicting a value from data
Q14 (a)	Identifying the property of metals according to their use
Q15 (b)	Describing a general trend
Q16 (a)	Oxygen is required for rusting to take place
Q17 (a)	Completing a flow diagram
Q17 (b)(ii)	Stating the pH of an acid
Q18 (a)	Naming a fossil fuel
Q18 (b)(i)	Using the data booklet to identify the fraction in which butane is found
Q18 (b)(ii)	Using a table of information to state the colour of a fraction
Q20 (a)(ii)	Using a key to name a hydrocarbon family
Q20 (b)	Drawing the structural formula for pentane

Credit level

Q2 (a)	Identifying the fraction used to tar roads
Q2 (b)	Identifying the fraction which is the most flammable
Q3 (a)	Selecting information (density) from the data booklet
Q6 (a)	Identifying an equation which represents neutralisation
Q7	Identifying correct information about an electron
Q10	Identifying statements about the rusting of iron
Q12 (b)(i)	Writing a general statement
Q12 (b)(ii)	Predicting a value
Q13 (a)	Drawing the structure of a monomer
Q13 (b)	Naming a toxic gas produced when a plastic burns
Q14 (a)	Concentration of hydrogen ions in an acid compared to pure water
Q14 (b)	Drawing a line graph
Q15 (c)(i)	Explaining what is meant by the term enzyme
Q16 (a)	Identifying and drawing structural formula for cyclopropane — as an isomer of C_3H_6 which does not decolourise bromine solution quickly
Q18 (a)	Identifying d.c. as the type of power supply used to electrolyse a solution
Q19 (a)	Indicating on a flow diagram how the Haber process is made more economical
Q19 (b)(i)	Naming the catalyst used in the catalytic oxidation of ammonia — as a step in the Ostwald process
Q19 (b)(ii)	Exothermic reaction — Ostwald process
Q20 (a)(i)	Balancing an equation
Q20 (a)(ii)	Identifying filtration as the technique used to separate a solid from a mixture
Q21 (c)	Identifying a piece of apparatus in a cell as an ion/salt bridge

Areas which candidates found demanding

General level

Q5 (a)	Identifying the formula for an ionic compound
Q5 (b)	Identifying diatomic molecules from formulae
Q9 (a)	Explaining why atoms are neutral
Q10 (c)	Writing a word equation
Q12 (b)	Naming a sugar which turns Benedict's solution orange
Q13 (a)	Respiration
Q13 (b)	Identifying water as a reactant in photosynthesis
Q14 (b)	Identifying 'ore' as the term used to describe naturally occurring compounds of metals
Q16 (b)	Writing Fe^{2+} as the symbol for the iron ion which turns ferroxyl indicator blue
Q17 (b)(i)	Describing how to test the pH of a substance
Q19 (a)(i)	Fair testing
Q19 (a)(ii)	Using time to compare the speed of a reaction
Q19 (b)	Test for hydrogen
Q20 (a)(i)	Using a general formula to write a molecular formula
Q20 (c)	The test for unsaturation
Q21 (a)(i)	Using the term 'electrolyte' to describe a compound used to complete a circuit
Q21 (a)(ii)	Direction of electron flow through wires
Q21 (b)	Explaining why batteries stop producing electricity

Credit level

Q1	Identify water as a solvent
Q3 (b)	Identifying elements which can form ions with the same electron arrangement as argon
Q3 (c)	Shape of molecules
Q4 (a)	Using melting and boiling point to identifying a substance which is a gas at 0^oC
Q4 (b)	Using information on conduction to identify substances as molecules
Q6 (b)	Identifying the reduction ion–electron equation involved in the rusting of iron
Q15 (a)	Writing the molecular formula for sucrose
Q15 (b)	Naming an isomer of sucrose
Q15 (c)(ii)	Identifying pH as a factor which affects enzyme activity
Q17 (a)	Identifying hydrolysis as the type of chemical reaction

Q17 (b)	Calculation from an equation
Q18 (c)	Identifying the charge on the cobalt ion in $CoCl_2$ as 2+
Q20 (b)	Identifying copper carbonate as a reactant with dilute acid
Q20 (c)(ii)	Calculating the number of moles of acid used in a titration
Q20 (d)	Using a balanced equation/ mole ratio to calculate number of moles of alkali
Q21 (a)	Direction of electron flow in a cell with no metals
Q22 (a)	Explaining what is meant by a homologous series

Areas of common misunderstanding

General level

Q1 (a) Some candidates selecting Si as symbol for silver which suggests they are not using the data booklet.

Q1 (b) A significant number of candidates gave nitrogen as having similar chemical properties to oxygen suggesting they are unsure of the difference between a group and a period.

Q5 (b) Many candidates identified NO_2 and CO_2 as being diatomic.

Q8 The majority of questions were awarded at least one mark out of two. A significant number of candidates wrongly identified molten sulphur as a conductor.

Q9 (a) A significant number of candidates described the structure of the atom rather than why atoms are neutral. Many also mentioned protons cancelling neutrons or positive and negative electrons.

Q9 (b) Many candidates circled halogens as being metals/ alkali metals being unreactive.

Q10 (c) The writing of the word equation was poorer than in previous years. A significant number tried to write an equation using symbols and formulae but were not able to write these correctly. There are still some candidates using an equals sign rather than an arrow and putting commas between the products rather than a + sign.

Q12 (b) A significant number of candidates thought that sucrose gave a positive result with Benedict's solution.

Q14 (b) Few candidates identified the term 'ore' correctly. Popular, incorrect answers included 'alloys' and 'synthetic'.

Q15 (a)(ii) Too many candidates are unable to draw a section of polythene using the monomer. Many candidates join the three monomer units together but fail to remove the double bond.

Q15 (b) Although well attempted overall, there is still a significant number who described each intermediate change.

Q16 (b)(i) A significant number of candidates stated that the formula for the iron ion which turns ferroxyl blue is Fe^{3+} or Fe(II) rather than Fe^{2+}.

Q16 (b)(ii) Although a significant number of candidates were able to state that magnesium provided sacrificial protection they also described this as magnesium providing ions rather than electrons to iron.

Q17 (b)(i) The majority of candidates were unable to describe how they would **add** pH paper/ universal indicator to the solution and then **match the colour** to a **pH chart** to measure pH. Many candidates described the colour pH paper/universal indicator turns in different solutions rather than how they would use pH paper/universal indicator to find pH.

Q19 (a)(ii) A significant number of candidates said experiment 2 took longer than experiment 1. Although this is true, the question asked for speed not time.

Q19 (b) There are still many candidates describing how they would use a glowing splint rather than a burning splint to test for hydrogen.

Q20 (c) A significant number of candidates are unable to identify bromine as the chemical used to test for unsaturation. Many candidates who correctly identified bromine then went on to describe it changing from orange to clear rather than colourless.

Q21 (a) Few candidates correctly identified 'electrolyte' as the correct answer. Many candidates responded that an ion bridge was the term used to describe the compound used to complete the circuit.

Q21 (b) Despite the wording of this question being used in several previous examinations, a significant number of candidates related cell to a living cell, thus saying the cell would die.

Credit level

Q1 Very few candidates correctly identified water as being the solvent when calcium hydroxide is dissolved in water.

Q4 (b) A significant number of candidates gave option E as a correct answer.

Q6 (b) A significant number of candidates gave option E as a correct response as it contained iron in the equation but it did not represent an equation involved in the rusting of iron. Few candidates correctly identified the equation representing electrons being gained by water and oxygen.

Q11 (b)(i) A significant number of candidates were unsure of the terms isotope/isomer.

Q11 (b)(ii) A significant number of candidates are unable to calculate the number of protons and number of neutrons from nuclide notation. Many candidates appeared to add the atomic number and mass number together to get the number of neutrons.

Q13 (a) Although this question was completed to a high standard there were still too many candidates who gave the repeating unit rather than the monomer.

Q14 (b) Although the line graph was well attempted by the majority of candidates some are still not putting a scale for temperature. They are using 0, 20, 30, 40, etc directly from the table rather than using a scale 0, 10, 20, 30, 40, etc.

Q15 (a) Few candidates were able to correctly give the molecular formula of sucrose as $C_{12}H_{22}O_{11}$. A significant number gave the formula for a monosaccharide or a formula which bore no relation to a carbohydrate.

Q15 (b) Many candidates stated that glucose or fructose is an isomer of sucrose.

Q15 (c)(ii) Most candidates related this to factors which affect speed of reaction, eg concentration, particle size rather than focusing on temperature and pH as being the factors which affect an enzyme in the way shown in the graph.

Q16 (b)(i) A significant number of candidates stated that a reason for using a catalyst was that the catalyst was not used up or could be re-used. Although this is true it is not a reason for using a catalyst. Few candidates were able to relate this to less energy/lower temperature required. A number of candidates also

mentioned that it reduced cost without relating this to less energy being needed.

Q17 (b) Few candidates correctly calculated the mass of ammonia produced from 90 g of urea. Common errors included arithmetical errors, calculating the mass of 2 mol of NH_3 as 31 g rather than 34 g and using the mass of water in their calculation.

Q18 (b) A significant number of candidates described what happens to the chloride ions at the positive electrode rather than what would be seen, ie bubbles of gas/ bubbles of chlorine gas.

Q18 (c) A significant number of candidates responded that the charge was positive rather than two positive.

Q19 (c) A significant number of candidates commented on the catalytic converter removing toxic gases rather than converting/changing them to less harmful gases.

Q20 (c)(i) A number of candidates correctly identified an indicator was required to show the end-point of the titration but included ferroxyl indicator in their answer.

Q20 (c)(ii) Although many candidates were able to identify $n = cv$, they failed to convert the volume given in the question (20 cm^3) into litres.

Q20 (d) A significant number of candidates used the pvc method which calculates the concentration, not number of moles. Few candidates were able to correctly use the mole ratio in the equation to identify the number of moles of alkali as being double the number of moles of acid.

Q21 (b) A significant number of candidates were unable to use the data booklet to identify the ion electron equation for the reaction taking place at electrode A. Many candidates used the symbol Ag rather than Au and used 2e- in their equation. Some candidates are still using an equals sign in place of an arrow.

Q22 (a) A large number of candidates were able to include either the idea of a general formula **or** similar properties in their answer but very few were able to give the full definition. Some candidates also mentioned same molecular/structural formula rather than general formula

Q22 (c) A large number of candidates lost the mark in this question as they said the type of reaction was addition polymerisation.

Advice to centres for preparation of future candidates

- Centres should stress to candidates that in stating the test for hydrogen they must mention ‘a burning splint pops’/ ‘burns with a pop’ and not ‘a glowing splint pops’

- Centres should stress to candidates that if they write a formulae equation when a word equation is asked for they will be penalised if any of the formulae are incorrect

- Centres should stress to candidates that an arrow is required to separate reactants and products in an equation and that an equals sign is not acceptable

- Centres should stress to candidates that when a molecular formula is asked for they should not simplify it, eg the molecular formula for hydrazine (Q10 (a) General level) is N_2H_4 and not NH_2

- In describing a general trend, candidates should be encouraged to indicate the trend between the starting and finishing points, ie trend increases or decreases

- Centres should stress to pupils that when asked for the formula for an ion they should show this as Fe^{2+} and not FeII or Fe(II). Centres should also stress that the charge should be written at the top right of the symbol

- Centres should stress to candidates the correct method of writing formulae, eg CO_2 — the two should be written as subscript/ at the bottom right of symbol and **not** CO2

- Candidates should be encouraged to use page 6 of the data booklet to identify the number of carbon atoms in a hydrocarbon rather than rote-learning this

- Centres should stress that in a cell electrons flow through wires and that page 7 of the data booklet should be used to identify the direction of electron flow between two metals

- Centres should point out the ion–electron equation on page 7 of the data booklet which represents water and oxygen gaining electrons during rusting

- Centres should stress to candidates that when calculating the gram formula mass of 2 mol of a compound they should calculate the gram formula mass then multiply by 2. This is to prevent the mistake made by a significant number of candidates who calculated the mass of $2NH_3$ as $2 \times 14(N) + 3 \times 1(H) = 31$ g rather than $2 \times 17 = 34$ g

- Centres should stress to candidates that the **size** and **type** of charge is required when asked for the charge on an ion, eg charge on the cobalt ion in $CoCl_2$ is 2+ or Co^{2+} and not ‘positive’ on its own

- Centres should stress to candidates that the purpose of a catalytic converter in a car exhaust system is to **convert/change** toxic gases into non-toxic gases rather then remove toxic gases

- Candidates should be encouraged to balance the equation printed on their exam paper rather than rewrite the equation and then balance it as a transcription error negates correct balancing numbers

- Candidates should be encouraged to learn basic chemistry definitions such as homologous series as well as the meaning of basic chemical terms, eg diatomic, non-biodegradable

- Centres should stress to candidates that the meaning of the term homologous series is marked as one or zero. To gain the mark, candidates must state the compounds have the same general formula **and** similar chemical properties. Either of these on their own is awarded zero marks

- Candidates should be encouraged to draw/write the type of formula asked for in the question. There appears to be a lack of knowledge in recognising the type of formula asked for in a question, eg when asked to write a molecular formula, a significant number of candidates draw a structural formula and vice versa

- Candidates should be encouraged to draw the arrow showing the direction of electron flow **on the wire** rather than in the space between the wire/voltmeter and ion bridge

Statistical information: update on Courses

Standard Grade

Number of resulted entries in 2010	18,905

Number of resulted entries in 2011	19,020

Statistical Information: Performance of candidates

Distribution of overall awards

Grade 1	33.2%
Grade 2	28.3%
Grade 3	25.5%
Grade 4	6.6%
Grade 5	4.8%
Grade 6	0.8%
Grade 7	0.1%
No award	0.7%

Grade boundaries for each assessable element in the subject included in the report

Assessable Element	**Credit Max Mark**	**Grade Boundaries**		**General Max Mark**	**Grade Boundaries**		**Foundation Max Mark**	**Grade Boundaries**	
		1	2		3	4		5	6
KU	30	21	16	30	19	14	30	11	n/a
PS	30	22	13	30	21	15	30	12	n/a