



External Assessment Report 2012

Subject(s)	Chemistry
Level(s)	Standard Grade General and Credit

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

There was an attempt to increase the level of demand in the Credit paper. However, feedback points to a slightly less testing paper than last year but still one that was fair and accessible to all. This is reflected in the cut-offs for the examination.

At General level, an attempt was made to maintain the level of demand with that from last year. However, there was a noticeable decline in the knowledge and understanding of candidates at general level and this is reflected in the lower than normal cut-off scores at KU.

Over the last few years it has been encouraging to see that the majority of candidates are giving the required number of responses in grid questions. However, it was commented on this year by Markers that a large number failed to circle the correct number of responses or failed to answer any of the grids at all.

Changes made to the assessment instrument 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

Question 1 (a): Selecting information (atomic number): from data booklet

Question 1 (c): Identifying elements which have similar chemical properties

Question 2 (a): Fair testing

Question 2 (b): Speed of reaction

Question 3 (a): Selecting information from data booklet — non-metals

Question 4 (a): Identifying the metal produced in a blast furnace

Question 7 (a): Identifying a hydrocarbon

Question 8 (a): Identifying the ion which turns ferroxyl indicator blue

Question 9: Identifying correct statements about the rusting of iron

Question 10 (a): Naming the structure at the centre of an atom

Question 11 (b): Explaining reactivity of metals found uncombined in the Earth's crust

Question 11 (c): Naming an alloy

Question 12 (a): Labelling a pie chart and calculating the percentage of one of the segments

Question 12 (b): Naming the family to which octane, nonane, etc belong

Question 13 (a) (i): Using pH values to identify the most acidic solution

Question 13 (a) (ii): Predicting current using information in table

Question 13 (b): Naming the ion present in all acidic solutions

Question 15 (d): Drawing the conclusion that oxygen is removed from a carbohydrate to produce a hydrocarbon

Question 16 (a): Naming electrons as the type of charged particle that flow through wires in a cell

Question 16 (b): Naming a metal which would replace another metal in a cell to produce a greater voltage

Question 16 (d): Presenting information as a bar chart

Question 17 (a): Naming the two gases which react to form nitrogen dioxide

Question 18 (b): Explaining why solid ionic compounds do not conduct electricity

Question 18 (c): Using information, stating the colour of the chloride ion

Question 19 (a): Identifying the least soluble solid from information in table

Question 19 (b) (i): Using a graph to conclude at what temperature two solids have the same solubility

Question 19 (b) (ii): Writing a general statement describing the effect of temperature on the solubility of a solid using information in graph

Credit level

Question 1 (b): Identifying the gas which burns with a pop

Question 2 (a): Identifying the fraction with the longest chain length

Question 3: Identifying spectator ions

Question 4 (b): Selecting information from the data booklet (flame colour)

Question 5 (a): Identifying the hydrocarbon which reacts with hydrogen to form butane

Question 5 (b): Identifying isomers

Question 5 (c): Identifying the structural formula of propene

- Question 6 (b): Identifying the equation which represents combustion
- Question 9: Identifying the two statements which apply to a proton
- Question 10 (b): Identifying the coated iron strip which has been galvanised
- Question 11 (a): Using a graph to identify the reaction which took the longest time to finish
- Question 12 (a): Presenting information as a line graph
- Question 12 (b): Using a graph to estimate yield of ammonia at 300 atmospheres
- Question 13 (b) (i): Identifying the salt in a neutralisation reaction
- Question 13 (b) (ii): Calculating average rate
- Question 14 (c): Naming a monosaccharide
- Question 15 (c): Calculating percentage mass
- Question 16 (b) (i): Identifying the electrode (positive or negative) magnesium is produced during electrolysis
- Question 17 (a) (i): Identifying the colour universal indicator turns when added to an acid
- Question 18 (b): Describing the relationship between concentration and freezing point using information in a table
- Question 19 (c): Naming the non-metal that conducts electricity
- Question 20 (a): Drawing a section of a polymer showing three monomer units joined together
- Question 20 (b): Naming the term used to describe a polymer which does not change shape on heating
- Question 21 (b): Naming the term used to describe a mixture of metals

Areas which candidates found demanding

General level

- Question 1 (b): Identifying diatomic molecules
- Question 3 (b): Identifying a mixture
- Question 5: Identifying a chemical reaction

Question 6 (a): Identifying compounds which do not contain oxygen

Question 7 (c): Identifying the gas produced when a metal reacts with dilute acid

Question 10 (b): Naming the family of elements to which fluorine belongs

Question 11 (a): Naming the industrial process used to make ammonia

Question 12 (c): Writing the molecular formula of eicosane using information in table

Question 14 (a): Naming the monomer used to make polystyrene

Question 14 (c): Identifying an advantage of using a packaging material made from starch compared to polystyrene

Question 15 (a) (i): Naming the chemical present in green plants which absorbs light energy

Question 15 (a) (ii): Describing the chemical test, including the result, for glucose

Question 15 (b): Fair testing

Question 15 (c): Identifying properties of starch (not sweet/ does not dissolve well in water)

Question 17 (b): Identify lightning as providing the high voltage spark to form nitrogen dioxide naturally in air

Question 17 (c): Suggesting a pH value for nitrogen dioxide

Question 20 (a) (i): Identifying cracking as the type of chemical reaction which produces smaller alkanes and alkenes

Question 20 (a) (ii): Completing a chemical equation — neutralisation

Question 20 (b): Using the result of testing an alkene with bromine to describe the structure of alkenes

Question 20 (c): Naming the solid produced in a precipitation reaction

Credit level

Question 1 (a): Identifying the two toxic gases produced during the burning of PVC

Question 6 (a): Identifying the equation which represents the formation of acid rain

Question 7 (a): Identifying the base

Question 8 (a): Identifying the process which is used to increase the alcohol concentration

Question 8 (b): Identifying the two processes which should be used to separate magnesium carbonate from a mixture of solid magnesium carbonate and solid magnesium chloride

Question 10 (a): Describing how coating iron prevents rusting

Question 10 (c): Identifying the coated iron strip (scratched) which would rust most quickly

Question 11 (b) (i): Suggesting a factor which could have been changed from one experiment to another

Question 11 (b) (ii): Mass of catalyst used in a reaction

Question 12 (c): Explaining why 500 °C is used rather than 200 °C in the Haber process

Question 14 (a): Naming the type of chemical reaction taking place when starch breaks down

Question 14 (b): Describing the effect of heating an enzyme on enzyme activity

Question 15 (a): Balancing an equation

Question 15 (b): Naming the type of chemical reaction taking place — neutralisation

Question 15 (d): Writing an ionic formula

Question 16 (a): Naming the type of chemical reaction taking place — displacement/redox

Question 16 (b) (ii): Writing an ion–electron equation (oxidation)

Question 17 (a) (ii): The effect of diluting an acid with water on pH

Question 17 (b): Calculating the number of moles of acid given the volume and concentration

Question 18 (c): Predicting the freezing point of a specific solution of sodium chloride

Question 19 (a): Naming the type of chemical reaction taking place from an ion–electron equation

Question 19 (b): Drawing an arrow on a cell to show the path and direction of electron flow

Question 20 (c): Drawing the structural formula of the product of an addition reaction with bromine

Question 21 (a): Naming the process used to extract aluminium from its ore

Question 21 (c) (ii): Calculating number of moles from mass

Areas of common misunderstanding

General level

Question 3 (b): A significant number of candidates were unable to identify air as a mixture. Many candidates responded that either water or sodium chloride were mixtures.

Question 5: A significant number of candidates identified distillation of crude oil as a chemical reaction.

Question 6 (a): A significant number of candidates identified compounds ending in -ite as those which do not contain oxygen.

Question 7 (c): A significant number of candidates identified chlorine as the gas produced when a metal reacts with dilute hydrochloric acid.

Question 10 (b): A significant number of candidates gave the family name of the group 7 elements as noble gases or repeated that they were group 7 elements.

Question 11 (a): A large number of candidates responded with the Ostwald rather than Haber process.

Question 12 (c): A large number of candidates had drawn the structural formula for a 20-carbon alkane rather than write the molecular formula.

Question 14 (c): A large number of candidates answered this question in terms of a disadvantage of polystyrene rather than an advantage of a material produced from starch.

Question 15 (a) (ii): A significant number of candidates gave iodine or bromine as the reagent used to test for glucose. A large number had the correct reagent but gave blue/black as colour change.

Question 15 (b) A significant number of candidates gave the same starting temperature as a factor the student would have kept the same to make a fair comparison.

Question 17 (b): A significant number of candidates responded that a car engine/spark plug provided the high energy spark in nature.

Question 17 (c): A significant number of candidates responded that the pH of the solution would be above 7.

Question 20 (a): A large number of candidates thought that hydrogen gas would be produced in the neutralisation reaction.

Question 20 (c): A large number of candidates responded with 'lead' as the solid produced in the precipitation reaction.

Credit level

Question 1 (a): A significant number of candidates were unable to identify carbon monoxide and hydrogen chloride as the two gases produced during the burning of PVC. The majority of candidates responded with carbon monoxide and carbon dioxide.

Question 6: It would appear that the inclusion of the equation representing the reduction of the sulphate ion caused candidates to choose this as the correct answer for the equation representing sulphur dioxide dissolving in water to form acid rain.

Question 10 (a): A large number of candidates described the coating of iron in terms of sacrificial protection/providing electrons rather than blocking water/air.

Question 10 (b) (ii): A large number of candidates responded that the iron coated with the scratched tin would rust most quickly.

Question 11 (b) (i): Despite being told in the question which factors were kept the same in both experiments, the majority of candidates responded with one of these factors, eg temperature, concentration. A large number also responded with changing the mass of zinc.

Question 11 (b) (ii): A large number of candidates tried to use equations such as $m = c \times v$ to answer this question.

Question 12 (c): A significant number of candidates took their answer from the table despite a lower yield being produced at 500 °C. Very few candidates recognised that this question was about the speed of reaction being affected by temperature.

Question 14 (b): A large number of candidates described the activity as increasing as they linked an increase in temperature to an increase in the rate of a reaction. A significant number of candidates also answered this question in terms of enzyme being denatured or indeed killed. The question asked specifically about the activity of the enzyme.

Question 16 (b) (ii): The majority of candidates either failed to recognise that ion–electron equations are given in page 7 of the Data Booklet, or they wrote the equation directly from page 7.

Question 17 (a) (ii): A large number of candidates recognised that the pH would increase when water was added to an acid. However, a significant number of candidates failed to recognise the pH value would not rise above 7.

Question 17 (b): A significant number of candidates recognised that $m = c \times v$ was to be used in this question. However, a significant number of candidates failed to change 50 cm³ into litres.

Question 18 (c): A large number of candidates did not put the minus sign in their answer.

Question 21 (a): A large number of candidates were unable to identify electrolysis as the method of extracting aluminium from its ore.

Question 21 (c) (ii): A significant number of candidates divided the gram formula mass (gfm) by the mass of aluminium rather than the mass divided by the gfm. There were also significant errors in the correct use of rounding.

Advice to centres for preparation of future candidates

- ◆ Centres should stress to candidates that when a molecular formula is asked for they should not draw the structural formula. Although the structure may be correct it will not be accepted as a correct answer when the question specifically asks for the molecular formula — see Q12(c) General.
- ◆ Centres should stress to candidates the correct use of writing symbols as candidates are penalised if this is not the case.
- ◆ Centres should stress to candidates the correct method of writing formulae, eg $C_{20}H_{42}$ — the numbers should be written as subscript at the bottom right of the symbol and not C20H42 — see Q12(c) General.
- ◆ 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/size of voltage.
- ◆ Centres should point out the ion–electron equations are provided in page 7 of the Data Booklet and that they can be written as they appear on page 7 or reversed.
- ◆ Centres should stress to candidates the correct use of rounding values from a calculation.
- ◆ 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.
- ◆ 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 types of chemical reaction, eg neutralisation, displacement, oxidation.
- ◆ Centres should stress to candidates that coating iron with another material acts to block water and/or air and that sacrificial protection operates when a more reactive metal is in contact with iron rather than coating iron.

- ◆ 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.
- ◆ Candidates should be made aware that when asked what factor could be changed to produce a specific set of results compared to another, it is necessary to specify not just the factor but the way in which it would be changed, eg larger particles rather than particle size, lower temperature rather than change temperature — see Q11(b)(i) Credit.
- ◆ Candidates should be encouraged to provide the number of responses asked for in each grid question and to attempt all questions, especially grid questions.
- ◆ Centres should stress to candidates that volume (cm^3) should be converted to litres by dividing by 1000.
- ◆ Candidates should be made aware of specific toxic gases produced when plastics containing chlorine and cyanide (HCl and HCN respectively) are burned in addition to carbon monoxide.
- ◆ Centres should stress to candidates that their answer must be specific to the question. Many candidates provide correct statements but they do not answer the question given.
- ◆ Candidates should be encouraged to read the entire question including any introduction to it and that any information specifically given in the introduction to the question cannot be given as an answer — see Q10(b) General and Q11(b)(i) Credit.
- ◆ Candidates should be encouraged to show working to calculations as partial marks can be awarded.
- ◆ Candidates should be encouraged to use the polymer name when asked for the name of the monomer used to make a specific polymer, eg polystyrene-**styrene**, polyethene-**ethene** etc.

Statistical information: update on Courses

STANDARD GRADE

Number of resulted entries in 2011	19,020
Number of resulted entries in 2012	18,747

Statistical information: performance of candidates

Distribution of overall awards

Grade 1	34.8%
Grade 2	27.7%
Grade 3	23.3%
Grade 4	6.2%
Grade 5	6.5%
Grade 6	0.9%
Grade 7	0.1%
No award	0.5%

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	23	18	30	17	11	30	9	n/a
PS	30	24	15	30	20	14	30	11	n/a