Version 2.0 22/08/2012

General Certificate of Secondary Education

Additional Science 4463 / Chemistry 4421

CHY2H Unit Chemistry 2

Report on the Examination

2012 examination – June series

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

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

Additional Science / Chemistry
Higher Tier CHY2H

General

The students appeared to have sufficient time to answer the paper and the majority of students were able to make a good attempt at almost all of the questions. Some excellent papers were seen.
Students should be reminded to write with black ink.

Question 1 *(Standard Demand)*

(a) Almost all students correctly gave the fact that chloride ions are negatively charged as the reason why they move to the positive electrode. A small number of students gained this mark by stating that they are "oppositely charged" or simply that they are "attracted".

(b) A small majority of students correctly chose the fact that "hydrogen is less reactive than sodium" as the reason why hydrogen is produced at the negative electrode and not sodium. Approximately 5% of students ticked more than one box.

(c) Only about a third of students knew that hydroxide ions make solution X alkaline. The most common incorrect responses were sodium, hydrogen and chloride/chlorine. A small number of students gave the name of solution X (sodium hydroxide). This did not gain credit.

(d) (i) A large majority of students were able to correctly show the arrangement of electrons in a molecule of hydrogen chloride. If crossings out are necessary, students should be encouraged to make their answers clear.

(d) (ii) A large majority of students were able to name the type of bond in hydrogen chloride as covalent.

(d) (iii) Approximately half the students knew that hydrogen ions give the solution a pH of 1.

Question 2 (Standard Demand)

(a) A large majority of students correctly calculated the mass of gas.

(b) Many students knew that using a balance weighing to more decimal places would make the results more precise. Other students gained this mark for the idea of using a measuring cylinder with smaller scale divisions. "Use a more sensitive balance" was also a creditworthy response but "use a more precise balance" did not gain credit since it added little to the words used in the question. The most common non-scoring answer was the idea of repeating the experiment.

(c) (i) Only about a quarter of students gained both marks for correctly calculating a mean value of 45.8. Most students included the anomalous result in their calculation, giving an answer of 47.25 which gained **1** mark.

(c) (ii) Approximately two thirds of students showed some understanding of experimental errors in the context of this question. The difficulty in transferring exactly 1 dm^3 of gas was widely appreciated, with "some gas escaped" being a common response. A

number of students gained two marks for stating that there might have been a change in the temperature and pressure of the room. Some answers did not relate to the experiment described or were too vague. Common examples of non-scoring answers were "faulty balance", "zero error", "human error", "systematic error", "measurement error" and "timing error".

(c) (iii) Most students understood why it was important to repeat the experiment, with the idea of improving reliability being the most common. Ideas of checking for anomalous results and being able to calculate a mean were also well represented. Among the answers that did not gain credit, "to make it more accurate" and "to check for errors" were the most common.

(d) Almost all students correctly calculated the relative formula mass of propane.

Question 3 ***(High Demand)***

(a) (i) The majority of students correctly named the acid. The most common incorrect response was chlorine/chloride.

(a) (ii) Although some students were able to describe precipitation reactions by stating that "the solution goes cloudy", only a minority were able to correctly give the meaning of a precipitation reaction in terms of a solid being formed.

(a) (iii) Only a minority of students correctly stated that the mixture should be separated by filtration. Common incorrect responses were electrolysis and evaporation/heating.

(a) (iv) The majority of students gained this mark, with the idea of making the calcium chloride safe for use in food being the most common. The idea of purification was also well represented and gained credit. Common non-scoring answers were "to make it suitable for food", “to separate it into different uses" and "to reduce waste".

(a) (v) Only a minority of students gained this mark with evaporation being the most common correct answer. Common incorrect answers were freezing and solidifying.

(b) (i) Approximately a third of students were able to correctly complete the half equation.

(b) (ii) Approximately a half of students were able to show correct understanding of the term oxidation in this context. Common incorrect answers were "loss of ions", "gain of electrons" and references to oxygen.

Question 4 ***(High Demand)***

The hardness of diamond was generally well explained in terms of its structure and bonding, with some excellent, comprehensive answers seen.
Some students made references to incorrect types of bonding, especially "intermolecular".
"Each carbon is joined to three others" was also stated by a significant minority of students. This type of error limited their mark to a maximum of two.

Question 5 ***(High Demand)***

(a) Many students gained a mark for indicating that ammonia is turned into a liquid in the separator but fewer gained a mark for stating that this is achieved by cooling the mixture. Common misconceptions were that the mixture is filtered or that the ammonia is heavier than the nitrogen and hydrogen. Some students stated that the

mixture is heated so that the nitrogen and hydrogen evaporate off, leaving the liquid ammonia. This did not gain credit.

(b) (i) Despite the reversible nature of the Haber process being quite frequently referred to, only a minority of students were able to link the fact that the forward reaction is exothermic to the effect of a decrease in temperature on the position of equilibrium. Some students confused exothermic and endothermic; other non-scoring answers attempted an explanation based on Le Chatelier's principle but only restated the information given in the question. Some weaker students attempted an explanation based on rate of reaction.

(b) (ii) Many excellent, comprehensive answers to this rate of reaction question were seen. Despite the fact that there were some references to particles vibrating which were ignored, most students gained a mark for stating that the particles have more energy or move faster when the temperature is increased. Fewer students, but still the majority, gained a mark for referring to the increased frequency of collisions or the increased proportion of collisions that result in a reaction. A small number of students appear to have the misconception that the activation energy increases when more energy is put into a system.

(b) (iii) Students found this question very difficult. Many students gave an explanation in terms of rate of reaction and did not make the link between the increased yield of ammonia and the numbers of reactant and product molecules in the chemical equation. A few students gave detailed answers in terms of Le Chatelier's principle which were, of course, accepted. The idea of the particles being squashed closer together was often given but did not gain credit.

(b) (iv) Approximately half of the students gained this mark with the most common response being a reference to the cost implications of using a much higher pressure. References to the risk of explosion were sufficient to convey the idea of such a high pressure being difficult to contain but responses such as "it would be too dangerous" were considered to be too vague to gain credit.

(c) (i) Approximately half of the students were able to use the mole ratio in the chemical equation to correctly calculate the volume of hydrogen needed. The most common incorrect answer was 20.

(c) (ii) Many of the students found this type of calculation very difficult but almost a fifth of students gained all three marks. The correct answer gained full credit even if there was no working but students should always be encouraged to show their working. It would be helpful to examiners if students would set out their working clearly since it is difficult to award marks to a jumble of numbers. The question revealed that a significant number of students do not fully understand the use of numbers and formulae in chemical equations; a common error was finding the mass of $2NH_3$ to be (2 x 14) + (3 x 1) = 31.

(d) (i) Most students correctly calculated the percentage yield of ammonia.

(d) (ii) The majority of students gained a mark for the idea that the unreacted nitrogen and hydrogen are recycled and put through the process again. Few students gained a mark for stating that the process is fast or that it is continuous. Despite being asked to give two reasons, most students gave only one reason.

Question 6 *(Standard / High Demand)*

(a) (i) Most students gained at least one of the two marking points awarded for a description of the structure of gold. Only the strongest students gained the third marking point for a description of metallic bonding in terms of attraction between positive ions and electrons. A small number of students used the data sheet to give the structure of a gold atom in terms of numbers of protons, neutrons and electrons. This did not gain credit.

(a) (ii) This question was well answered although some students gave answers such as "because it's an unreactive metal" or "because its atoms are tightly packed together" without conveying the idea that electrons can move through the structure or simply stating that gold contains "delocalised electrons".

(b) Students found this to be a challenging question. Some answers lacked sufficient depth; a common response was the idea of a surface layer acting as a barrier. Other students went no further than stating that the corrosion of metals is an oxidation process. Only a few students gained two marks for considering the formation of an ionic compound in which the ions are not free to move. A significant minority of students gained a mark for the idea that there are no delocalised electrons in the corroded surface layer (or fewer delocalised electrons in the metal as a whole).

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA website

UMS conversion calculator www.aqa.org.uk/umsconversion