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ASSESSMENT and QUALIFICATIONS ALLIANCE

## General Certificate of Secondary Education

# Chemistry 4421

## CHY3H Unit Chemistry 3

# Report on the Examination

*2008 Examination – January Series*

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# Chemistry
# Higher Tier CHY3H

### General

This was the first examination of the new Specification.

While most candidates had been entered for the correct paper, it appeared that there was a significant number of candidates who were insufficiently prepared for this examination and, unusually for a paper of this type, a very noticeable number of questions or parts of questions were left blank.

These weaker candidates would have had a less than positive experience and perhaps would have been better suited to the, or should been entered for the examination later in the academic year once they had been better prepared and gained in maturity.

The following questions proved particularly difficult for this cohort of candidates: question 3 ,hardness of water, question 5, titration, and question 6(a), analysis. In the past, Higher Tier candidates have done well with these questions.

Questions that were less well answered tended to be those involving specific knowledge that had to be learned and those that required careful explanations and the use of specific scientific terminology. Candidates do need to make the effort to learn carefully the factual material given in the Specification.

Candidates should be reminded to write their answers clearly in black ink or ball-point pen and within the space provided. Note that when candidates give several answers when only one or two are required, they might not be credited for their correct ideas if errors or contradictions are included in their response.

Questions 1 and 2 are standard demand questions and are common with questions 5 and 6 on the Chemistry Foundation Tier Paper CHY3F.

This report should be read in conjunction with the published mark scheme.

### Question 1 *(Standard Demand)*

In part (a) the most common error involved candidates just repeating the question and saying, the smallest amount gave a rise of 15$^{o}$C which was quite high. Better candidates worked logically through the calculation.

In part (b) most candidates were able to suggest an environmental problem associated with the burning of vegetable oil, although some suggested acid rain. Fewer candidates went on to say how the problem could be overcome and focussed on containing the smoke rather than removing it, or suggested it should be burned in remote areas.

While *activation energy* was well known in part (c)(i), less than half the candidates knew that **B** (rather than **C**) represented the energy given out during the reaction.

### Question 2 *(Standard Demand)*

In part (a)(i) generally the candidates drew a smooth curve using a sharp pencil and extrapolated the curve to between 5.4 and 6.4 g/dm$^3$ at 50$^{o}$C. In part (a)(ii) most candidates correctly read the appropriate value from their graph. In part (a)(iii) the calculation was usually done correctly although the most common error was for candidates to use the *y*-axis as a 0.1 scale rather than 0.2. A good discriminator and some good reasoned responses were seen in part (a)(iv). Many thought that only the value at 50$^{o}$C was estimated or that there would be more human error at higher temperatures.

(b)(i) Many did not answer the question and just said that the fish would die at 26$^{o}$C. Part (b)(ii) was very well done by the majority of the candidates, although there were some vague comments about the effect on wildlife or stopping the trout from being killed. Part (b)(iii) was quite well answered with the majority of the candidates scoring both marks. The popular answers being that the management would only be putting small quantities of water into the lake or that the water would cool quickly, and that the council would suggest that trout will die above 26$^{o}$C because there would be less oxygen.

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

Although some excellent answers were seen, this question was very badly answered by a significant number of candidates who appeared to know nothing about this topic.

In part (a) 62% of the candidates gained no credit. *Soap* was often not mentioned in the context of *scum*, and *heat* omitted in the context of *scale*. Responses such as scale is hard and scum is soft were often seen. There were many vague statements such as scale is a build-up on pipes or scale affects pipes. Candidates needed to suggest that scale is formed when hard water (or water containing $Ca^{2+}$/$Mg^{2+}$) is heated and that scum if formed when hard water reacts with soap. Scum is not formed when water is lathered with soap.

In part (b) 43% of the candidates gained no credit. There were vague answers such as take out the hard water ions / neutralise the positive charge / replace positive ions by negative ions / add sodium carbonate ions. Some thought that hydroxide ions caused water to be hard.

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

Part (a)(i) was well answered by all but the weakest candidates. Part (a)(ii) was well done by most candidates but some confused physical and chemical properties, or simply said they were placed in proton number order without comment.

In (b)(i) most candidates linked group number to the number of outer electrons and many also linked the periods to the number of energy levels (shells) or stated that the table was arranged in increasing atomic (proton) number order. However, many seemed not to realise that three marks required three pieces of information. Elements in the same group do not have the same number of outer shells and neither do they have the same number of atoms in the outer shell. Many candidates were careless in the use of language and referred to moving along a group and moving down a period. Others referred to placing the elements in order of increasing atomic mass. In part (b)(ii) 40% of the candidates correctly reasoned that it would mean splitting a proton or an electron. The popular incorrect response was that gaps hadn't been left or that there is no space for another element.

There were some excellent answers were seen from the more able candidates in part (c). As usual in a question such as this, a comparison is required so it is essential to include comparative terms such as more/most, closer/closest, stronger/strongest or easier/easiest. Simply saying easy, close or strong is insufficient. Candidates needed to mention outer electron/outer energy level somewhere in their answer to receive full credit. Some candidates thought the important factor was that fluorine only needed to gain one electron, while other candidates thought fluorine lost an electron and suggested group 7 elements became more reactive down the group. Other candidates thought that intermolecular/magnetic/gravitational forces held the electrons to the nucleus.

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

In part (a) there were some excellent, accurate descriptions from some candidates. However, just over 50% of the candidates gained no credit, many left the question blank or gave a list of equipment without comment or wrote nonsense involving invented apparatus such as biurets and titrating tubes. Many incorrect colour changes were mentioned and it was insufficient to simply say that the alkali is added until the indicator shows neutral. Candidates should mention that the final burette reading was noted.
Candidates should have no problems about the spelling of burette using the 1,2-rule: the **1st** problem letter is an r and there is **1** of those, the **2nd** problem letter is a t and there are **2** of these. The same rule applies to the spelling of pipette and potassium.

In part (b) just under a quarter of the candidates knew how to do this standard calculation. A few candidates gained partial credit for 13.5/25 = 0.54.

About 60% of the candidates gained credit in part (c). Popular incorrect responses involved the suggestion that titration was inaccurate or that neutralisation made the champagne safe.

In part (d) only the best candidates gained full marks but many gained some credit for stating that methyl orange is used for strong acid/weak base titrations or for recognising that phenolphthalein is used for weak acid/strong base titrations. Weak candidates had little or no idea.

**Question 6 *(High Demand)***

In part (a)(i) although there were some excellent candidates who gained full credit, over 60% of the candidates scored nothing. This question required candidates to use the named materials to identify the chemicals, specific, accurate chemical knowledge was required. It was clear that too many candidates had either not made the effort to learn these tests or that they had not been taught this topic. The carbonate test, linked to its result, was best known, while the test for nitrates was least well known. Many candidates just put in a reagent at random and others did not give a result. The use of silver nitrate, for sulfates, and barium chloride, for chlorides, appeared frequently. Hydrochloric acid is not used to acidify silver nitrate solution in the chloride test, this answer appearing in spite of candidates being given silver nitrate acidified with nitric acid! The word *precipitate* was an unknown quantity for many.

In part (a)(ii) a majority of candidates recognised that the substances were all sodium compounds. However, many candidates missed the point and stated that flame tests are for metals or that flame tests are not for negative ions.

Part (b) was well answered, with fast/small amount/accurate being the most common correct responses. Many candidates think that the use of computers avoids the risk of human error or that unskilled people can operate expensive instruments used for mass spectrometry, IR and NMR.

**Mark Ranges and Award of Grades**

Grade boundaries and cumulative percentage grades are available on the **Results Statistics** page of the AQA Website.