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General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Report on the Examination

2008 Examination – June Series

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Science B / Chemistry
Higher Tier CHY1H

General

There were seven questions on the paper. The first two were common to Foundation and Higher Tiers. They were targeted at grades D and C. The final five questions were targeted at grades B to A*.

The mark scheme was designed to allow candidates to gain marks for showing knowledge, understanding and application of chemistry. The majority of candidates appeared to have sufficient time to complete the paper and very few questions were left un-attempted.

Basic knowledge and understanding of how science works in everyday situations, including in the laboratory, are tested throughout this paper. This means that it is essential that candidates read and analyse the information provided, then read the question before writing their response.

Question 1 *(Standard Demand)*

In part (a)(i) most candidates knew the correct names of the two products. Marks were awarded for writing correct formulae instead of names. The name of the type of chemical reaction was known by the majority of candidates in part (a)(ii). A wide range of incorrect answers were seen such as electrolysis, precipitation, oxidation, exothermic, reduction etc.

Many candidates gained full credit in part (b)(i) for realising that when quicklime and water react the reaction is exothermic. Frequent incorrect responses were water or quicklime reacting with the coffee or insulation or they correctly stated that the reaction gives out heat but then called it a thermal decomposition or an endothermic reaction. Many candidates stated that the solution heats up, which is in the stem of the question, rather than the heat is released or produced by the reaction.

In part (b)(ii) the majority of candidates were able to suggest either chemical or physical reasons why it was not possible to re-use the self-heating can.

Question 2 *(Standard Demand)*

The information to answer part (a) was given in the table. The vast majority of candidates gained credit for this question, usually for short carbon chain length. Sometimes the word it was incorrectly used to refer to fuel-oil, although some candidates correctly stated that fuel-oil has larger molecules. A few, more able, candidates referred to the intermolecular forces.

Information used from the table enabled most candidates to score marks in part (b). Many candidates were able to compare the high demand for, and short supply of, petrol in relation to fuel oil. Some candidates equated the boiling points or height up the column to the energy need to extract the petrol and the fuel oil without realising that the crude oil is heated to a constant, high temperature to vaporise all of the fractions in the table.

Part (c) was well answered by most candidates. A large number of candidates who scored maximum marks were aware that the process of cracking would reduce the length of the carbon chains. Better answers also described that cracking involved heating in the presence of a catalyst. Many candidates were obviously confused with other processes: heat to 60^{o}C with a nickel catalyst was a frequent incorrect description of the process. Although fractional distillation can be used to separate the products of cracking, a number of candidates thought that this was used to effect the reduction of hydrocarbon chain length.

Question 3 ***(Standard Demand)***

The majority of candidates gave a suitable explanation of the importance of identifying colour additives in food in part (a). It was not enough to just say to know what's in it. Amplification was needed, such as a safety point, a health point or a permitted point which could include religious or ethical reasons.

For part (b) many candidates answered purely in terms of E104 and made no reference to the other colour. Many also, incorrectly, identified the large spot as the brown colour. Several candidates thought that the inclusion of the unknown colour would make the brown colour safe. There was a disappointing number of candidates who identified it as containing both E104 and E133 and an equally surprising number who said it contained neither. Some candidates seemed to think that the dot at the same level as E104 was an additive similar to but not the same as E104, showing that they did not fully understand the science.

One mark was the most common outcome of part (c), usually for stating that there could be other additives in the sweets. Several candidates thought that if an additive is not harmful, then it cannot be an additive or if it is natural it is not harmful. Many candidates realised that colour additives were only one type of additive and most of these candidates provided examples of other categories of additives. Very few candidates suggested that natural colours could be used.

Question 4 ***(Standard Demand)***

The vast majority of candidates were awarded a mark for part (a), mostly for selecting one of the properties, usually the 45% lighter idea from the stem of the question.

Most candidates used the information provided and suggested a possible reactivity series in part (b). Generally it appears that candidates do have a good understanding of the reactivity series.

Many candidates misunderstood the part (c) and wrote in terms of the better properties of titanium. The most common correct response was to mention the smaller amount of titanium produced. Many candidates stated incorrectly that this method of titanium extraction was expensive because it was done by electrolysis, although some explained correctly that the high cost was due to extraction of the magnesium by electrolysis. Steel being an alloy also confused many candidates. Many simply thought that the only expense of steel is in its production from iron, forgetting the iron itself needs to be extracted from its ore. A frequent, unsuitable answer, was Titanium is more expensive than steel because it costs more to make. An explanation of the reasons for this extra cost was required to gain any credit.

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

In part (a)(i) most candidates stated the correct oil and explained why it was best in terms of both polyunsaturated fat and saturated fat content. A few candidates appear to have misunderstood the information in the introduction and selected palm oil. This question involved numbers from a table so candidates are expected to manipulate or compare both of the relevant numbers. An answer which just quotes numbers is inadequate. Ideally answers should have included superlatives such as highest and lowest. More or high level of were given credit because these indicate some degree of understanding.

In part (a)(ii) most candidates suggested a correct reason as to why the use of olive oil in food preparation decreases the likelihood of heart disease.

In part (b)(i) the first part several candidates did not fully read or understand the information given and had the oil changing colour. Unfortunately, there is still a disappointing number of candidates who equate clear to colourless.

Part (b)(ii) asked for a comparison with the other oils. While less precise answers were accepted in part (a)(i), in this part sunflower oil has neither the highest, nor the lowest, result, so a precise comparison was needed with other, named, oils. An answer such as it's in the middle does not indicate if it is more or less unsaturated than say olive oil. It was also possible to gain credit by working out the number of grams of polyunsaturated fat per 100g of sunflower oil by comparing results with the data in part (a). There was confusion by some candidates that more unsaturated fat content means less saturated fat content.

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

The stem of part (a) did state that coal contains both carbon and sulfur. However, a small number of candidates only addressed one of them. Many candidates did not realise that a chemical reaction occurs between the sulfur and the carbon in coal, with oxygen from air. Many left them as carbon and sulfur and simply stated carbon and sulfur are given off. Several candidates scored well on this question with carbon dioxide causing global warming and sulphur dioxide causing acid rain as the most common correct explanation. A common misconception is that a greenhouse gas and the greenhouse effect are environmental problems. The problem is global warming and its effects. References to the mining of coal and the effect on the landscape were rare but, nevertheless, gained credit. Comments such as bad for the environment or cause pollution did not gain credit because they do not explain why burning coal causes environmental problems.

The most common response to part (b) scored only two marks for saying that although wood released carbon dioxide into the atmosphere when burnt, the tree had taken in the same amount while it was growing and so it is carbon neutral. Some went on to score the third mark by mentioning that the trees were renewable or could be replanted or sustainable. Most candidates did not appreciate that this neutrality will only work if new trees are planted to absorb the carbon dioxide emitted, else the forest would be completely cut down eventually. Very few candidates appreciate that coal burning releases carbon that has been locked away for millions of years. A common misconception was that wood does not release any or as much carbon dioxide as coal. Additionally a worrying number asserted that wood did not contain carbon so would not cause any pollution. Some candidates thought that carbon dioxide was locked away in trees meaning that when wood burns no carbon dioxide is produced.

Question 7 ***(High Demand)***

Part (a) was well answered by the majority of candidates. The decrease in carbon dioxide and increase in oxygen due to the evolution of green plants was the most obvious and most common response, and the more able candidates also linked this to photosynthesis. The role of carbonate rocks and the oceans were less frequently put forward as explanations for the decrease in the amount of carbon dioxide in Earth's atmosphere. The most common error was due to misreading the question and answering in terms of modern day changes in the atmosphere due to human activities. Relatively few candidates selected nitrogen as a gas to write about.

Few candidates scored both marks on part (b). Lack of understanding of negative temperatures often led to no marks being awarded, for example, many candidates thought that Titan had a higher surface temperature than the boiling point of methane. An analogy would be with the boiling point of water and Earth's average temperature. A small number of candidates were able to gain the how rain forms mark even though most envisaged methane perpetually above its boiling point on Titan. These candidates showed an understanding of the processes of evaporation and boiling and realised, but were unsure how, the methane condensed to form rain.

Candidates, in general, attempted a structural formula in part (c)(i). Most common errors were carbon skeletons, without hydrogen; having two or no double bonds between carbons or two

hydrogens plus a CH_2 group on the second carbon to get the correct number of H's (CH_2=CH_2-CH_2). A few correctly drawn dot and cross diagrams were seen and given credit.

In part (c)(ii) some candidates understood the topic well, and understood the concept of building a polymer from monomer units, with most of these candidates gaining credit for joining them together to form a long chain molecule. The majority of candidates were able to name the polymer as polypropene, poly(propene) or polypropylene. Sometimes it was difficult to decipher if the name of the product was poly(propene) or poly(propane). Chemical names need to be clear and unambiguous, particularly where a different spelling has a different meaning or shows a lack of understanding.

Mark Ranges and Award of Grades

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