AQA

A-LEVEL
CHEMISTRY

7405/1 Inorganic and Physical Chemistry
Report on the Examination

7405
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Question 1

In 01.1, 21% of students gained both marks; common errors included stating that the concentrations are equal or that forwards and backwards reactions are equal, without reference to rate. Many students gained the mark in 01.2. Answers to 01.3 were generally good with 68% gaining all the marks. Most students gave the correct expression in 01.4; common errors included missing *p* (reference to partial pressure) or using square brackets. Answers to 01.5 were good. About half the students scored both marks in 01.6; most students scored the mark for units. Some students worked out a K_p value using a rearranged expression rather than just taking the inverse of the K_p from question 01.5.

Question 2

A third of the students scored both marks in the definition; common errors included failing to mention average mass of atoms and missing atom or mass of ^{12}C. Question 02.2 was answered well by most students; the most common error was using 100 as the denominator. Answers to 02.3 were good; some students unnecessarily added that the number of protons was the same and a few students did not refer to electrons and stated that chemical properties depend on the number of neutrons. In 02.4 many students scored full marks; the main errors were calculating the mass of the Re^+ ion in kg, omitting to take a square root and incorrect rearrangement of the equation. Answers to 02.5 were generally poor; only 21% of students scored both marks. Many students did not refer to the ion gaining an electron at the detector and many simply stated that the number of ions reaching the detector gave the abundance of the ion without any reference to the current produced.

Question 3

Most students could not give a correct equation in 03.1; if they did score the equation mark they generally carried on to complete the calculation correctly. 21% of students scored all the marks in this question. A minority had an incorrect ratio in the equation that they then used correctly in the calculation, and so scored 4 marks. The most common responses used the 3:4 ratio given in the question. Converting 5% to 100% proved challenging for many so they could not score M5. The question discriminated very well. Only the most able scored the mark in 03.2; many students referred to colour changes that were the wrong way round. Very few understood the concept of self-indicating in the titration. Most students gave the correct answer in 03.3; the most common incorrect answers were +1 and –2. In 03.4, 41% of students gave a correct equation and then carried on to score all the marks. Many students did not score the final mark as they did not use the factor of 2. Some students did not convert the volume correctly and some rearranged the equation incorrectly. In 03.5, only 5% of students gained all the marks. Most students did not give a correct definition; many referred to energy rather than enthalpy, many did not refer to 1 mol and many omitted stating that the value was averaged over many compounds. Many found processing the bond breaking/bond forming data difficult but were able to access M5.

Question 4

Most students scored well in 04.1; errors included not giving their answer to 2 decimal places or omitting to take the square root. In 04.2, 49% of students scored all the marks. The most common error was failing to multiply by 2 to get the concentration of hydroxide ions. Question 04.3 was very challenging and very few students achieved both marks; most students did not realise that there was the same amount of hydroxide ions and therefore the volume of hydrochloric acid would be the same. Students found 04.4 challenging; only 5% scored all three marks. Many scored intermediate marks. Although there was reasonable appreciation of the need to mix ethanoic acid with potassium hydroxide solution, far fewer acknowledged the need to leave the acid in excess. The equation was the most likely mark to be achieved. Only a minority could successfully account for the buffer's resistance to pH change. Some had OH^- reacting with the added H^+, whilst others referred to the shifting of an equilibrium without identifying it; very few stated that the added H^+ reacts with the ethanoate ions. In 04.5, the correct answer was achieved by 40% of students. Common errors in the extended calculation included failure to score the second mark for the amount, in moles, of CH_3COOH after alkali addition, adding 0.5 to 0.05 to get an incorrect amount of salt and trying to use an equation with $[H^+]^2/[HA]$. This question discriminated very well.

Question 5

56% of students scored the mark in 05.1. The equation in 05.2 was more challenging, with many students not knowing the formula of aluminium oxide or aluminium sulfate; of those who did, many could not balance the equation. Question 05.3 proved challenging and only 13% of students scored all the marks. Common, incorrect reagents suggested were litmus, sodium hydroxide and limewater. Most students who scored 3 marks gave pH/universal indicator for the reagent and subsequent correct observations. Some students suggested barium chloride but then got the observations the wrong way around. Several students stated carbonate ions as the reagent, but this is an incomplete name so failed to gain the first mark. Very few students scored both marks in 05.4. The equation in 05.5 was correctly given by 18% of students; many students did not know the products of the reaction or gave an equation starting from P_2O_5. Several students gave the correct molecule in 05.6 but did not give the displayed formula as asked for in the question. About 20% of answers to 05.7 scored marks at level 3 (5/6 marks). Often the indicative content was not well explained or was very muddled. Some students mixed up ions and molecules and some confused which bonds/intermolecular forces were being broken to measure the melting point; many thought that covalent bonds were broken in chlorine and hydrogen chloride, the two molecules.

Question 6

Most students knew the answer to 06.1. In 06.2, most students knew the equation but did not mention electrons in their explanation; many referred to oxidation numbers. Of those who mentioned electrons in the explanation, some stated that chlorine gained electrons but then thought oxygen or hydrogen lost electrons. Many students stated that a brown or purple gas was given off in 06.3 and many students did not give an ionic equation; 33% of students scored both marks. In 06.4, most students knew the role of sulfuric acid. The equations were not well known, however, and some students gave half-equations. Several students gave a correct equation for sulfur rather than a gas containing sulfur. Students found 06.5 challenging; 10% scored all the marks in the question. Carbon dioxide was scored more often than the other marks. Many students could not give the equation and many thought the sodium halide was NaCl. 36% of students gained all three marks in 06.6. Many students gave structures with only one lone pair and explanations often stated that the lone pairs and bond pairs repelled each other without stating that the lone pair-lone pair repulsion was greater then the bond pair-bond pair repulsion. Common incorrect bond angles were 120^o and 180^o. About half the students gave a correct equation in question 06.7; common errors included the wrong formulas for titanium chloride and magnesium chloride and using Mg_2 in the equation.

Question 7

43% of students scored both marks in 07.1. More students gained the first mark for stating that light was absorbed; some did not score the second mark since they did not say that yellow light was reflected and a few stated that yellow light was emitted. 07.2 was answered well; some students gave the correct expression but then did not calculate correctly and a few did not rearrange the expression correctly. Answers to 07.3 were generally good with many students gaining 2 or 3 marks. Most students knew the shape in 07.4. In 07.5, 50% of students gave the correct equation; a common error was to have 2 Cl_2 as a product. In 07.6, some students did not state that the solution was deep blue and many could not give a correct equation; many students gave complexes with six ammonia ligands and chlorine gas as a product. The correct formula was given, in 07.7, by 53% of students; the most common error was a 2+ charge on the complex.

Question 8

Less than half the students gave a correct answer in 08.1; Zn was a common incorrect response. In 08.2, few students realised that the porous separator was acting as a salt bridge; a common misconception was that it was ‘separating reactions’ or ‘stopping electrolyte & paste mixing’. The equation in 08.3 was not answered well; 29% of students gained this mark. Many students gave the reverse equation or gave a correct one but did not cancel the water and hydroxide ions. Question 08.4 was very challenging; only 7% scored both marks. Many students calculated the standard electrode potential correctly although common errors were – 0.4 V and 2.06 V. In 08.5, most students did not realise that the overall equation for the cell reaction is the same in each cell.

Mark Ranges and Award of Grades

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