



**General Certificate of Education (A-level) Applied
January 2011**

Applied Science

SC11

**(Specification
8771/8773/8776/8777/8779)**

Unit 11: Controlling Chemical Processes

Report on the Examination

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Set and published by the Assessment and Qualifications Alliance.

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General Comments

It was clear that a number of candidates were well prepared. However, a significant number were unable to deal with areas of the specification such as equilibria and rates of reaction. Whilst most attempted to sketch the Maxwell-Boltzmann curve, many seemed unaware of the correct general shape. The terms 'reactant' and 'product' were all too often transposed by candidates.

Unfortunately, a significant number of candidates were unable to deal with the process of squaring numbers, a fraction where the denominator had two numbers multiplied, or with standard form.

Question 1

- (a) Generally well answered. Some candidates transposed reactants and products and others simply referred to the scale of the process.
- (b) A large number of good answers seen. Some did not refer to a reaction occurring and several simply described a batch process as stop/start which is insufficient to score.
- (c) This was very well answered. Only a small proportion of candidates failed to gain merit. Some still simply state lower costs without qualification and therefore cannot score.
- (d) (i) Many correct answers were seen, although some candidates incorrectly chose to define a dynamic equilibrium here.
 - (ii) The majority of candidates were able to substitute the correct numbers. Many then were unable to calculate the correct answer either because they multiplied a number by 2 rather than by itself or because they entered the division into their calculator incorrectly.
 - (iii) A number of correct answers were seen. Many, however, simply wrote down the units of concentration and so scored zero.

Question 2

- (a) (i) Surprisingly, only a small number of candidates recognised this reaction of an acid with a base as a neutralisation. Incorrect answers included combustion, oxidation and reduction.
 - (ii) A large number of candidates correctly balanced the equation. A significant number failed to complete this question.
 - (iii) Most answered this correctly. Only a few incorrect answers were seen.
- (b) (i) Whilst a large number of correct answers were seen, a significant number gave only a vague answer here and so did not score. Many referred to 'amount' instead of

giving a specific quantity.

- (ii) Many candidates seemed to be intending to carry out an enthalpy of combustion experiment and therefore failed to score. Some excellent thorough answers were seen.
 - (iii) Some good answers were seen. Many candidates continued to talk about an enthalpy experiment and measured temperature change. Others described heating the reaction mixture or heating the calcium carbonate pieces in a calorimeter with water. Several had no details of what was being recorded as the result. Another incorrect answer involved titrating nitric acid against a standard calcium carbonate solution.
 - (iv) A surprising number simply said 'keep everything the same' and so gained no marks here. Most candidates could specify at least one variable to keep the same and most scored full marks here.
- (c) Most candidates answered this question extremely well. A significant number, however, thought that smaller pieces would have a reduced surface area. Several incorrect explanations then followed such a statement to try to justify the increased rate, such as 'smaller pieces give increased energy, lower activation energy or increase the overall total number of particles'. Some candidates incorrectly talked about particles having less room to **move around** in the smaller pieces.

Question 3

- (a) (i) Mostly well answered. A few candidates failed to calculate either molecular mass correctly and some gave units to their masses.
- (ii) Many correct answers were seen. The most common error was rounding too early in the calculation. Some did not round numbers but truncated them instead and units were missed in a significant number of cases.
- (iii) Generally well answered. The main error that led to a candidate not scoring was a discussion of heat/energy loss.
- (b) Generally well answered. Many candidates incorrectly took the sum of the products' enthalpies of formation from the sum of the reactants' enthalpies. Some confused their Hess's cycle completely.
- (c) Whilst a good number of candidates identified that this was the heat energy required to break a bond, many seemed to think energy was also required to make bonds and so did not gain merit. Only the best candidates discussed the idea that values for several different compounds were averaged.
- (d) This was well answered, with the major error being transposing the subtraction. Some candidates needed to exhibit greater care when noting down their calculated numbers. Several trivial arithmetic errors were made.

- (e) Some candidates thought that heat loss or incomplete reaction should be discussed here. Many answered well.

Question 4

- (a) (i) Generally answered well. Some candidates failed to identify that the forwards and reverse **reactions** occur. A significant number did not mention rate.
- (ii) Answered very well. The few incorrect answers seen were ones where candidates attempted sketches of concentration against time for the reactants and products.
- (b) Most candidates discussed opposing the change. A significant number failed to mention that there would be an equilibrium.
- (c) Although some very good answers were seen, most candidates attempted to discuss rate and yield together. Their answers required structure. Two separate discussions would have provided some structure and gained QWC marks.
- (d) (i) Many candidates were unable to identify the correct effect. A significant number discussed the effect on rate rather than yield. Most, however, stated that the forward reaction was exothermic and so gained a mark here. The explanation of equilibrium shifting was only seen from a small number of candidates.
- (ii) Whilst a few excellent answers were seen, the majority of candidates were unable to talk about the balance between rate and yield. Incorrect answers included safety and melting point of ammonia.

Question 5

- (a) Many good answers. Disappointingly, a large number of candidates thought that a catalyst took no part in a reaction rather than stating it was 'reformed at end' or that it was 'not used up' overall.
- (b) (i) Extremely well answered. Only a few incorrect answers were seen. These had often simply missed the word 'minimum'.
- (ii) Whilst a number of excellent answers were seen, a large proportion of candidates drew a normal distribution curve rather than the skewed curve required for a Maxwell-Boltzmann distribution. Only a few seemed to attempt to show the asymptote at high energies.
- (iii) Many candidates correctly labelled both energies. However, a significant number failed to show either on the x axis and some thought the addition of the catalyst would give a different distribution of energies.

- (iv) The majority of candidates knew that a catalyst lowered the activation energy but explained no further. Others incorrectly thought that a catalyst is an energy source and so failed to score.

Question 6

- (a) (i) Many excellent answers seen. Unfortunately some candidates were unable to explain their choice of order appropriately. A significant proportion was unable to determine the correct order.
- (ii) Many correct answers seen. Incorrect answers included concentrations, or some people doing experiment.
- (b) (i) The majority of candidates were able to explain zero order. Some failed to mention that the rate was unaffected when the **concentration** of Y was altered.
- (ii) Well answered.
- (iii) Whilst this was answered well, many candidates incorrectly began their expression with 'k=.....' rather than 'rate = k.....' and so could not score.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the [Results statistics](#) page of the AQA Website.