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Examiners' Report
October 2025

Pearson Edexcel International Advanced Level in Chemistry
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General Comment

The majority of candidates performed well on this paper and were able to apply their knowledge and understanding of the topics in the specification in familiar and novel situations. The average score was 66%.

Questions involving calculations scored highly but the layout of these often made the working difficult to follow, especially where error transfers needed to be applied.

In general, learners performed very well on the multiple-choice section, showing that they had been very well prepared for this. The most accessible question was **2(c)** on the shapes of rate/concentration graphs and the most difficult proved to be **9(b)**, in which candidates had to calculate the standard atomisation energy of iodine using a Born-Haber cycle. Question **11** also proved to be challenging, where learners had to deduce the structure of a condensation co-polymer from 2 different monomers.

Question 14

14(a) The majority of learners were able to give a correct expression for K_p and go on to correctly calculate its value and state its units from the data given. A common error amongst weaker candidates was to substitute moles into their expression, rather than working out mole fraction and partial pressure.

14(b) Proved more challenging with only the very strongest candidates scoring all three marks. The majority demonstrated a good understanding of how changes in temperature and pressure affect the position of equilibrium and scored the first two marks. The final mark proved much more illusive with the majority of candidates simply stating a link between temperature and pressure but failing to appreciate the compromise between the two. What was needed was an appreciation that (even though a higher temperature would reduce yield,) a high(er) temperature was needed otherwise the rate would be too slow.

Question 15

15(a) The majority of candidates were able to give a correct structure for butane-1,2-diol but a significant number seemed unfamiliar with balancing an equation using [H] (and by inference [O]) and so could not access the balancing mark.

15(b) A large majority (80%) of learners were able to assimilate the information given in the question stem to give a correct colour change. Weaker candidates simply stated that there would be a colour change without giving the detail.

15(c) Most candidates were able to deduce that butane-2,3-diol has hydrogen bonding but only the best few candidates scored the second mark by linking the high(er) boiling temperature with the energy needed to overcome the stronger hydrogen bonds.

15(d) The quality of answers was very mixed for this question. Most candidates were able to deduce that butane-2,3-diol showed optical isomerism and that this was due to the presence of chiral carbons. Putting this into words was the challenge for many candidates with some simply not linking the two together and missing either the optical isomerism mark or the chiral carbon mark, but rarely both. It appears that practise in structuring answers to this type of question would be beneficial.

15(e)(i) Learners found this question quite challenging. Three marks were available for comparing the esterification reaction using propanoic acid and with propanoyl chloride, but the average score was just under 1. Even though, in many cases, appreciation of some differences was shown, answers lacked the comparative detail to score the marks. For example, an answer that stated: "Propanoyl chloride gives a higher yield, a faster reaction and produces HCl as a byproduct"; whilst being fully correct would only score one mark. What is missing is that propanoic acid needs a catalyst to achieve a faster rate and that propanoic acid produces water. Learners needed to appreciate that "identify three differences" means compare two things for each difference.

15(e)(ii) A slight majority of learners were able to give a fully correct structure, but a significant number did not appreciate that butane-2,3-diol has two alcohol functional groups, so would react with two propanoic acid molecules. There was also a large number of impossible structures given, showing that candidates need to practise drawing the products of esterification reactions for more complex molecules.

15(f) The majority of candidates were able to give two correct wavenumber ranges and link these to bonds. The most common sources of missed marks were not drawing the bond correctly, especially for the alcohol group. Only one bonds should be shown and these need to be shown explicitly. For instance –C=O or OH would not score (it should be C=O and O–H.

15(g) This also proved relatively challenging, with scores of three being in the minority. A good number of learners showed their understanding of NMR spectroscopy by giving three single peaks in the correct places but many of these lost the final mark by not following the instruction to include the responsible atoms in their answers. Weaker candidates did not appreciate that butanedione only produces a singlet in the ^{1}H NMR and drew various multiplets on the ^{1}H spectrum.

Question 16

This was the six mark question and it proved to be more accessible than many 6 markers with the average score being 3.47. As is common with this type of question, many answers lacked structure and/or failed to address all the points in the question stem and/or discussed (often at length) points that are irrelevant to the question. The majority of candidates were able to state that potassium chloride was (almost) purely ionic and calcium iodide was ionic with covalent character but learners sometimes failed to link this correctly with the lattice energy differences. Most appreciated that Ca^{2+} has greater charge density so is more polarising and I^{-} is larger than Cl^{-} so is more polarisable. A common error here, though, was to talk about atoms rather than ions.

Question 17

17(a) Two thirds of all learners were able to give the correct IUPAC name for lactic acid.

17(b)(i) The nucleophilic addition mechanism is one of the more complex mechanisms in the IAL chemistry specification, yet the question was answered very well. Learners were clearly well rehearsed in this mechanism with a high proportion scoring full marks. The most common error was the omission of δ^{+} on the H of H–CN in the final step. Many more learners would have scored full marks but for this single error.

17(b)(ii) Just over 60% of learners correctly identified step 2 of the synthesis as hydrolysis. A few clearly identified it as such but their spelling of the word was too poor to score.

17(c) This was answered very well with 70% of candidates able to give a correct balanced equation for the reaction. The commonest errors were omission of H_2O and/or CO_2 as a product; omission of an oxygen in the carboxylate group of the salt; and although charges were not necessary on the carboxylate salt, if they were used, they both had to be present but occasionally, one was missed.

Question 18

18(a)(i) very few candidates were unable to complete the table correctly.

18(a)(ii) The quality of the graphs was very mixed and clearly, this needs practise. The majority of candidates were able to score the marks for labelling axes and for plotting points, but choice of a suitable scale proved more challenging with over half of candidates choosing a scale that was too small. In many cases, the points only spanned 3 large squares on the x axis.

18(a)(iii) Clearly, the vast majority of learners were practised in this calculation with a very high proportion of correct answers given. However, a large number of learners lost a mark by not giving the unit for the gradient, even though this was asked for in the question.

18(b) Accessing all the marks for this question proved very challenging for the majority of learners. Most were able to state the correct relationship between rate constant and temperature, but many answers were lacking in detail for the explanation. In particular, for the final mark, where candidates talked about collisions, many lost the mark by omitting the word "successful", or by not stating a time frame such as "frequency" or "per second"

Question 19

19(a)(i) Here, candidates had to suggest two observations for a given reaction, but this proved surprisingly difficult for many. The most common correct answer related to the formation of a gas, so bubbles or fizzing were acceptable answers, yet many still fell into the trap of saying "a gas is formed" which does not score as it is not an observation. Many talked about the smell of the gas but in terms too vague to score -a more specific answer, such as pungent was required. Even though only two observations were asked for, many candidates gave a long list and on occasion marks were lost due to one or more of their incorrect observations contradicting correct ones.

19(a)(ii) This question proved a little more accessible and the concept of entropy change seemed to be well understood. Virtually all learners could give the correct sign for the entropy change and most could give at least one reason to justify the sign with a good proportion giving both reasons.

19(b) This was a multi-step calculation where candidates first had to calculate a value for $\Delta S^{\circ}_{system}$ in part (i), a value for ΔH, in part (ii) then use these in part (iii) to calculate a value for ΔS°_{total}. Learners were clearly well rehearsed in this calculation with the majority giving numerically correct answers throughout. There were two main sources of error. The first problem was in the layout of working. The majority of candidates did not show full working with intermediate values, for instance, the entropy of the products and the reactants in part (i). This was fine for those that got the correct answer but for those that made an error in calculating, it was often not possible to deduct where the error had occurred so all the marks were lost,

whereas, if full working with intermediate values was displayed, some marks may have been salvaged. It cannot be stressed enough, that learners should be taught to show all working, including intermediate values, and set out in such a way that it can be easily followed by markers. Learners should also study the mark schemes for such questions to learn how the answers are set out so they can reproduce this in an exam. The second issue occurred in part (iii). The question asked candidates to "Include a sign and units in your answer". Although almost all gave appropriate units, a large number lost the mark by not putting a + sign in front of their final answer. A third error, which is repeated in every series is that candidates forget to divide their $\Delta S^{\circ}_{system}$ value by 1000 so it is consistent with the units for ΔH.

19(c)(i) The vast majority of learners appreciated that entropy increased when the cover was removed but a large number of these failed to score the second mark because they could not give a succinct enough explanation. A simple statement stating that the chlorine and air mixed together was all that was required, but many learners failed to grasp this.

19(c)(ii) This was an unusual question about the distribution of quanta, yet the vast majority of learners were able to spot the pattern and figure out the answer. The minority of students that did not score appeared to not appreciate that the two numbers in each column had to add up to four.

19(d) Most candidates appreciated that entropy increases with temperature, giving a line with a positive gradient. However, those that understood there is a sharp increase at melting and boiling were far fewer. Even among candidates who did appreciate this, the quality of diagrams was often very poor and it appears that many learners had not been exposed to such a graph.

19(e) This proved to be the most difficult question on the paper and demonstrated that very few candidates understood the entropy changes in the dissolving of an ionic compound. Scores of zero were common place and very few candidates scored more than one. The very best candidates were able to state that in solid sodium chloride, the ions are fixed but in solution they are free to move, but even these failed to secure the third marking point by appreciating that the entropy of the solvent also increases, not just the solute.