



AP[®] Chemistry 2003 Scoring Commentary Form B

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Question 1

Sample 1A (Score 10)

The answers are clear and well organized in this excellent response, which earned a full score: 1 point each for parts (a) and (b), 2 points each for parts (c), (d), (e), and (f).

Sample 1B (Score 9)

This is a good response. In part (c), one point was earned for indicating that $[HI]$ is equal to $[I_2]$, but the second point was not earned because the stoichiometry relating the amount of HI reacting to the amount of $H_2(g)$ or $I_2(g)$ forming is incorrect.

Sample 1C (Score 6)

The point was not earned in part (a) because the exponent on $[HI]$ is missing. In part (c), the equilibrium concentrations of H_2 and $[I_2]$ are incorrect, but they are indicated as being equal, earning one point. Although the expression for K_c used in part (e)(i) is incorrect due to the error in part (a), the values are correctly substituted and the calculation is done correctly, hence the one point is earned. The response in part (f) earned no points.

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Question 2

Sample 2A (Score 10)

This response earned a perfect score. A summary of the earned points for the response is as follows: 2 points for part (a)(i), part (a)(ii), part (b)(i) and part (b)(ii), and 1 point each for part (a)(iii) and part (b)(iii).

Sample 2B (Score 8)

In part (a)(ii) of this good response, the limiting reactant is correctly identified but not sufficiently justified, thus only one point was earned. In part (b)(iii), the fact that 0.600 mol of $\text{Ba}(\text{NO}_3)_2$ is the sole source of nitrate ion is overlooked, leading to an incorrect result that earned no point.

Sample 2C (Score 7)

In this response, only one point was earned in part (b)(i) because an incorrect formula mass for $\text{Ba}_3(\text{PO}_4)_2$ is used. In part (b)(ii), a point is earned for the correct numbers of moles of NO_3^- formed, but the calculation of pH is unfinished, so the second point was not earned. A common error is shown in part (b)(iii); no point was earned because dissolved HNO_3 is responsible for only part of the NO_3^- in the solution.

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Question 3

Sample 3A (Score 10)

This is an excellent response with explicit and complete answers. For part (a), 3 points were earned; parts (b)(i) and (b)(ii) earned 2 points and 1 point, respectively. In part (c), 2 points were earned, and 1 point each was earned for parts (d)(i) and (d)(ii).

Sample 3B (Score 8)

This is a good response. Only 1 point was earned in part (b)(i) because of the use of STP conditions instead of the conditions indicated in the question. In part (d)(ii), the wrong sign is given to ΔT , so only 1 point was earned in part (d).

Sample 3C (Score 7)

In part (a) of this response, an incorrect calculated mole ratio of C to H results in the wrong, but consistent empirical formula, so 2 out of 3 points were earned. For part (b)(ii), the final answer is correct, but is not verified by the work shown, so no point is earned. The mass of C_7H_{16} is incorrectly incorporated into calculations for ΔT in part (d)(ii), and no point is earned.

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Question 4

Sample 4A (Score 15)

This excellent response earned a perfect score of 15 points. Each of the five chosen reactions has the correct formulas and charges for the reactant(s) (1 point) and for the product(s) (2 points). No spectator ions or extraneous species are shown.

Sample 4B (Score 13)

In this good response, reactions (c), (d), (e), and (f) are written correctly. In reaction (h), 1 point was earned for the acetic acid product; no reactant point was earned because solid $\text{NaC}_2\text{H}_3\text{O}_2$ is not shown as a reactant.

Sample 4C (Score 10)

In this response, reaction (b) and (g) earned full credit, 3 points each. For reaction (a), only the 1 reactant point was earned because the products are incorrect. For reaction (f), only 1 of the 2 possible product points is earned because of the incorrect charge on sulfate ion. For reaction (h), only 1 point was earned overall -- for the acetic acid product.

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Question 5

Sample 5A (Score 9)

This response earned a near perfect score of 9 points; 1 point for part (a), 2 points each for parts (b) and (c), 2 out of the possible 3 points for part (d), and 2 points for part (e). The second point was not earned in part (d) because there was no statement that the volume of the KMnO_4 solution must be in liters.

Sample 5B (Score 8)

This good response earned full credit for parts (a) through (d). No points were earned for part (e), which incorrectly focuses on concentration rather than simply the number of moles of KMnO_4 .

Sample 5C (Score 7)

In part (c) of this response, only 1 of the 2 points was earned because the mass of the oxalic acid sample is left out. In part (d), 1 of the 3 points was not earned because the volume must be specified as liters; in part (e), the answer is correct but the explanation is not, thus only 1 point was earned.

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Question 6

Sample 6A (Score 9)

This is an excellent response that earned the maximum score for each of the parts: 2 points for part (a), 1 point each for parts (b) and (c), 3 points for part (d), and 2 points for part (e).

Sample 6B (Score 8)

This response is very good, but in part (e), one point is not earned because Le Châtelier's Principle does not apply to the system, which is not in equilibrium.

Sample 6C (Score 5)

In this response, only 1 point was earned in part (a) because the equation is not correctly balanced. No point was earned for part(c), because the anode was incorrect. The justification for the inappropriateness of CuS is incorrect in part (d), so only 2 of the possible 3 points were earned. Finally, no point was earned for the justification given in part (e).

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Question 7

Sample 7A (Score 8)

This response earned full credit, 2 points for each of the four parts. In part (a), 1 point was earned for indicating that Cl^- is larger, and 1 point was earned for pointing out that Ca^{2+} has a larger nuclear charge. In part (b), 1 point was earned for indicating a characteristic by which CO and Pb differ, and 1 point was earned for indicating a behavior that is different in C and Pb . In part (c), 1 point was earned for indicating that Kr has empty d orbitals, and 1 point was earned for indicating that He does not have vacant orbitals. Finally, in part (d), 1 point was earned for explaining that B and Be have different electron configurations, and 1 point was earned for explaining why it is easier to remove the first electron from B .

Sample 7B (Score 6)

This response is good, and earned 2 points each for parts (a), (b), and (c). The response for part(d) provides no correct reason and lacks any discussion of subshells, thus it earned no points.

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Question 8

Sample 8A (Score 8)

This excellent response earned a perfect score: 1 point each for parts (a), (b), (c), (d)(i), (d)(ii), and (e), and 2 points for part (d)(iii).

Sample 8B (Score 7)

This response is good, except that no point was earned for part (e), because the half-life will remain the same regardless of any change in temperature.

Sample 8C (Score 5)

In this response, no point was earned in part (b) because a neutron is not identified as the source of the beta particle. In part (d)(iii), the explanation of how to use the graph fails to specify that k is the negative of the slope of the graph, so only 1 point was earned. In part (e), no point was earned for the incorrect answer and justification.