AP® Chemistry
2001 Sample Student Responses

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5A

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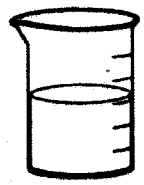
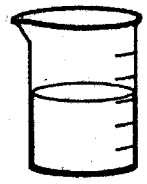
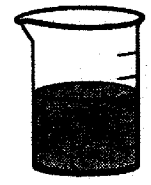
Your responses to the rest of the questions in this part of the examination will be graded on the basis of the accuracy and relevance of the information cited. Explanations should be clear and well organized. Examples and equations may be included in your responses where appropriate. Specific answers are preferable to broad, diffuse responses.

Answer BOTH Question 5 below AND Question 6 printed on page 18. Both of these questions will be graded. The Section II score weighting for these questions is 30 percent (15 percent each).

Solution 1	Solution 2	Solution 3	Solution 4	Solution 5
				
0.10 *M* $Pb(NO_3)_2$	0.10 *M* NaCl	0.10 *M* $KMnO_4$	0.10 *M* C_2H_5OH	0.10 *M* $KC_2H_3O_2$

5. Answer the questions below that relate to the five aqueous solutions at 25°C shown above.

(a) Which solution has the highest boiling point? Explain.

(b) Which solution has the highest pH? Explain.

(c) Identify a pair of the solutions that would produce a precipitate when mixed together. Write the formula of the precipitate.

(d) Which solution could be used to oxidize the $Cl^-(aq)$ ion? Identify the product of the oxidation.

(e) Which solution would be the least effective conductor of electricity? Explain.

a) Solution 1 has the highest boiling point because it has the most ions dissolved in the water. Due to this, there are fewer water molecules at the surface that can become gas so it will take more heat to boil.

b) Solution 5 has the highest pH because the $C_2H_3O_2^-$ ions will react with water to form acetic acid and hydroxide ions, making the solution basic.

c) Solution 1 and Solution 2 would produce a precipitate

$Pb^{2+} + 2Cl^- \longrightarrow PbCl_2$

d) Solution 3

$Cl^- + MnO_4^- + H^+ \longrightarrow Mn^{2+} + Cl_2 + H_2O$

e) Solution 4 would not conduct electricity well because it is not made up of ions that will conduct electricity but a single molecule.

5B

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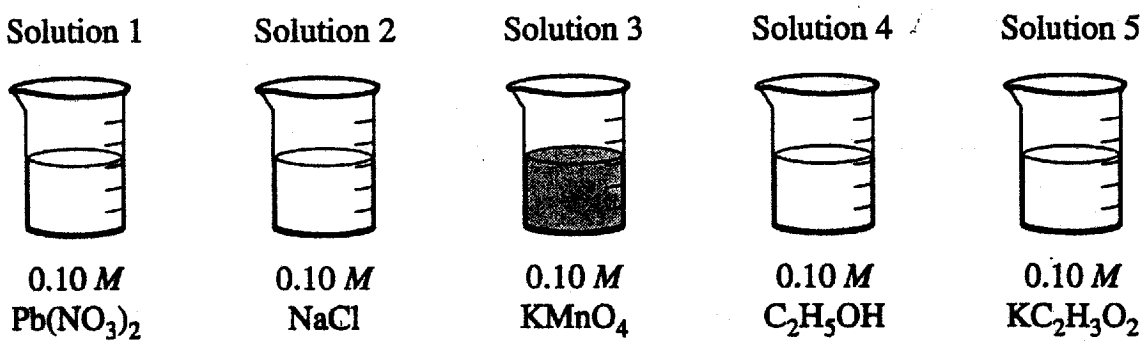

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(d) Which solution could be used to oxidize the $Cl^-(aq)$ ion? Identify the product of the oxidation.

(e) Which solution would be the least effective conductor of electricity? Explain.

(A) The $Pb(NO_3)_2$ solution will have the highest boiling point because it is the solution with the largest and heaviest ions in solution. It will take a longer time and more heat to get these molecules moving fast enough to become a gas than any of the other choices.

(B) The solution with the highest pH will be the $KC_2H_3O_2$ because the $C_2H_3O_2^-$ ion will ~~pair with~~ take an H^+ from the water molecules present and produce OH^- ions in solution, making it very basic.

(C) The solutions that, when mixed, will form a precipitate are the $Pb(NO_3)_2$ and the NaCl. They will form the precipitate $PbCl_2$.

ADDITIONAL PAGE FOR ANSWERING QUESTION 5.

(D) The $KMnO_4$ solution can be used to oxidize the Cl^- solution because the MnO_4^- will go to Mn^{+2}, which is being reduced and will play the role of the oxidizing agent to take on electrons.

(E) The C_2H_5OH will be the least effective conductor of electricity because it will not dissociate into as ~~many~~ much ~~ions~~ the rest of the solutions, which dissociate highly and are ~~good~~ strong electrolytes.

5C

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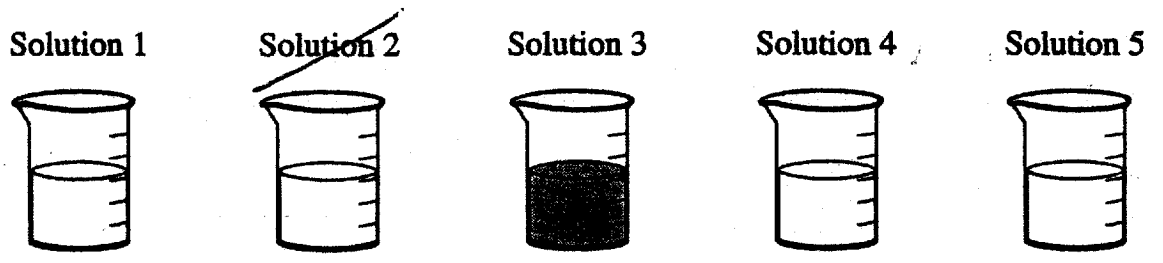

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(b) Which solution has the highest pH? Explain.

(c) Identify a pair of the solutions that would produce a precipitate when mixed together. Write the formula of the precipitate.

(d) Which solution could be used to oxidize the $Cl^-(aq)$ ion? Identify the product of the oxidation.

(e) Which solution would be the least effective conductor of electricity? Explain.

5. a. solution 4 has the highest boiling pt. because of the H-bonding that occurs between the C_2H_5OH and H_2O, thus decreasing the vapor pressure of the solution.

b. Solution 5 has the highest pH because it is a basic salt solution, and thus KOH is a strong base, where as HC_2H_3OO will have a limited dissociation, and is a weak acid

c. solution one and 2 will combine to form a precipitate: $Pb^{+2} + 2Cl^- \rightarrow PbCl_2\downarrow$

ADDITIONAL PAGE FOR ANSWERING QUESTION 5.

d. solution 3 could be used to oxidize the Cl^- the product of the oxidation would be

e. the least effective conductor of electricity will be solution four, which contains C_2H_5OH a non-electrolyte. Thus because no dissociation occurs, it will not be a good electrical conductor.