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 11. Both of these questions will be graded. The Section II score weighting for these questions is 30 percent (15 percent each).

5. In a laboratory class, a student is given three flasks that are labeled Q, R, and S. Each flask contains one of the following solutions: $1.0\,M$ $Pb(NO_3)_2$, $1.0\,M$ $NaCl$, or $1.0\,M$ K_2CO_3. The student is also given two flasks that are labeled X and Y. One of these flasks contains $1.0\,M$ $AgNO_3$, and the other contains $1.0\,M$ $BaCl_2$. This information is summarized in the diagram below.
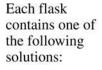

(a) When the student combined a sample of solution Q with a sample of solution X, a precipitate formed. A precipitate also formed when samples of solutions Q and Y were combined.

  (i) Identify solution Q.

  (ii) Write the chemical formulas for each of the two precipitates.

(b) When solution Q is mixed with solution R, a precipitate forms. However, no precipitate forms when solution Q is mixed with solution S.

  (i) Identify solution R and solution S.

  (ii) Write the chemical formula of the precipitate that forms when solution Q is mixed with solution R.

(c) The identity of solution X and solution Y are to be determined using only the following solutions: $1.0\,M$ $Pb(NO_3)_2$, $1.0\,M$ $NaCl$, and $1.0\,M$ K_2CO_3.

  (i) Describe a procedure to identify solution X and solution Y.

  (ii) Describe the observations that would allow you to distinguish between solution X and solution Y.

  (iii) Explain how the observations would enable you to distinguish between solution X and solution Y.