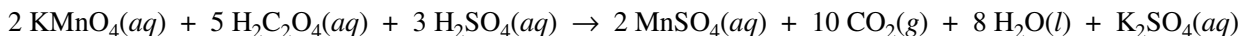


2003 AP[®] CHEMISTRY FREE-RESPONSE QUESTIONS (Form B)

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

5. Oxalic acid, $\text{H}_2\text{C}_2\text{O}_4$, is a primary standard used to determine the concentration of potassium permanganate, KMnO_4 , in solution. The equation for the reaction is as follows.



A student dissolves a sample of oxalic acid in a flask with 30 mL of water and 2.00 mL of 3.00 *M* H_2SO_4 . The KMnO_4 solution of unknown concentration is in a 25.0 mL buret. In the titration, the KMnO_4 solution is added to the solution containing oxalic acid.

- (a) What chemical species is being oxidized in the reaction?
- (b) What substance indicates the observable endpoint of the titration? Describe the observation that shows the endpoint has been reached.
- (c) What data must be collected in the titration in order to determine the molar concentration of the unknown KMnO_4 solution?
- (d) Without doing any calculations, explain how to determine the molarity of the unknown KMnO_4 solution.
- (e) How would the calculated concentration of the KMnO_4 solution be affected if 40 mL of water was added to the oxalic acid initially instead of 30 mL? Explain your reasoning.