

## 2003 AP<sup>®</sup> CHEMISTRY FREE-RESPONSE QUESTIONS



3. In a study of the kinetics of the reaction represented above, the following data were obtained at 298 K.

Experiment	Initial $[\text{Br}^-]$ (mol L <sup>-1</sup> )	Initial $[\text{BrO}_3^-]$ (mol L <sup>-1</sup> )	Initial $[\text{H}^+]$ (mol L <sup>-1</sup> )	Rate of Disappearance of $\text{BrO}_3^-$ (mol L <sup>-1</sup> s <sup>-1</sup> )
1	0.00100	0.00500	0.100	$2.50 \times 10^{-4}$
2	0.00200	0.00500	0.100	$5.00 \times 10^{-4}$
3	0.00100	0.00750	0.100	$3.75 \times 10^{-4}$
4	0.00100	0.01500	0.200	$3.00 \times 10^{-3}$

- (a) From the data given above, determine the order of the reaction for each reactant listed below. Show your reasoning.
- (i)  $\text{Br}^-$
  - (ii)  $\text{BrO}_3^-$
  - (iii)  $\text{H}^+$
- (b) Write the rate law for the overall reaction.
- (c) Determine the value of the specific rate constant for the reaction at 298 K. Include the correct units.
- (d) Calculate the value of the standard cell potential,  $E^\circ$ , for the reaction using the information in the table below.

Half-reaction	$E^\circ$ (V)
$\text{Br}_2(l) + 2 e^- \rightarrow 2 \text{Br}^-(aq)$	+1.065
$\text{BrO}_3^-(aq) + 6 \text{H}^+(aq) + 5 e^- \rightarrow \frac{1}{2} \text{Br}_2(l) + 3 \text{H}_2\text{O}(l)$	+1.52

- (e) Determine the total number of electrons transferred in the overall reaction.

# S T O P

**If you finish before time is called, you may check your work on this part only.  
Do not turn to the other part of the test until you are told to do so.**