The following data was collected by the method of initial rates for the reaction at 25°C'

$BrO_3^-(aq) + 5\ Br^-(aq) + 6\ H^+(aq) \longrightarrow 3\ Br_2(aq) + 3\ H_2O(l)$

EXPT	$BrO_3^-]$	$[Br^-]$	$[H^+]$	Rate, m/s
1	0.10	0.10	0.10	8.0×10^{-4}
2	0.20	0.10	0.10	1.6×10^{-3}
3	0.20	0.20	0.10	3.2×10^{-3}
4	0.10	0.10	0.20	3.2×10^{-3}

What is the Rate Law for the Reaction?

1. Rate = $[BrO_3^-][Br^-][H^+]$
2. Rate = $[BrO_3^-]^2[Br^-][H^+]$
3. Rate = $[BrO_3^-][Br^-]^2[H^+]$
4. Rate = $[BrO_3^-][Br^-][H^+]^2$

Correct Answer: **4.**

Comments to the instructor: When holding bromide ion and hydrogen ion concentrations constant, doubling the bromate ion concentration doubles the rate, so the reaction is first order with respect to bromate ion. When holding bromate ion and hydrogen ion concentrations constant, doubling the bromide ion concentration doubles the rate, so the reaction is first order with respect to bromide ion. When holding the bromate ion and bromide ion concentrations constant and doubling the hydrogen ion concentration, the rate quadruples, so the reaction is second order with respect to hydrogen ion.

Calculate the rate constant for the reaction at 25°C

$BrO_3^-(aq) + 5\ Br^-(aq) + 6\ H^+(aq) \longrightarrow 3\ Br_2(aq) + 3\ H_2O(l)$

under the following conditions:

Rate = 8.0×10^{-4}M/s; $[BrO_3^-] = 0.10$ M; $[Br^-] = 0.10$ M; $[H^+] = 0.20$ M

1. $k = 1.0 \times 10^{-3} / M^2\ s$

2. $k = 0.20 / M^3\ s$

3. $k = 0.1 / M^3\ s$

4. $k = 2\ s\ M^3$

Correct Answer: **4.**

Comments to the instructor: Based on the rate law established in the previous problem, Rate = $[BrO_3^-][Br^-][H^+]^2$ *, the correct answer is 2 s* M^3*. Most of the other choices are the result of algebraic errors or arithmetic errors.*