第 14 題:

The following set of data was obtained by the method of initial rates for the reaction:

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

Calculated the initial rate when BrO_3^- is 0.30 M, Br^- is 0.050 M, and H^+ is 0.15 M

Expt	$[BrO_3^-]$ (M)	$[Br^-]$ (M)	$[H^+]$ (M)	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	0.15	0.10	2.4×10^{-3}
4	0.10	0.10	0.25	5.0×10^{-3}

(A) 6.1×10^{-5} M/s (B) 2.7×10^{-3} M/s (C) 5.3×10^{-3} M/s (D) 8.4×10^{-2} M/s

ANS: (B)

$r = k[BrO_3^-][Br^-][H^+]^2$

$k = 8$ $r = 8 \times 0.30 \times 0.050 \times (0.15)^2 = 2.7 \times 10^{-3}$

【精選範例】

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

	BrO_3^- mol/L	Br^- mol/L	H^+ mol/L	Rate
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}

$Rate = k[BrO_3^-]^n[Br^-]^m[H^+]^p$

$Rate2/Rate1 = (1.6 \times 10^{-3})/(8.0 \times 10^{-4}) = \dfrac{k(0.20)^n(0.10)^m(0.10)^p}{k(0.10)^n(0.10)^m(0.10)^p}$

$2 = 2^n$, $n = 1$

$Rate4/Rate1 = (3.2 \times 10^{-3})/(8.0 \times 10^{-4}) = 4 = \dfrac{k(0.10)^n(0.10)^m(0.20)^p}{k(0,10)^n(0.10)^m(0.10)^p}$

$4.0 = (2.0)^p$, p = 2

同理 Rate3/Rate2 → m = 1

Rate = $k[BrO_3^-][Br^-][H^+]^2$

8.00×10^{-4} mol $L^{-1}s^{-1} = k(0.10$ mol/L$)(0.10$ mol/L$)(0.10$ mol/L$)^2$

k = 8.00 L^3 $mol^{-3}s^{-1}$

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