14.36 The following data were collected for the rate of disappearance of NO in the reaction $2 \, NO(g) + O_2(g) \longrightarrow 2 \, NO_2(g)$:

Experiment	[NO] (M)	[O$_2$] (M)	Initial Rate (M/s)
1	0.0126	0.0125	1.41×10^{-2}
2	0.0252	0.0125	5.64×10^{-2}
3	0.0252	0.0250	1.13×10^{-1}

(a) What is the rate law for the reaction? (b) What are the units of the rate constant? (c) What is the average value of the rate constant calculated from the three data sets? (d) What is the rate of disappearance of NO when [NO] = 0.0750 M and [O$_2$] = 0.0100 M? (e) What is the rate of disappearance of O$_2$ at the concentrations given in part (d)?

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(A) Double NO_2 O_2 const $=$ $4 \times$ increase

Double O_2 NO_2 const $= 2 \times$ increase

$$Rate = k\,[NO_2]^2\,[O_2]^1$$

(B) $$Rate = k\,[NO_2]^2\,[O_2]^1$$

$$\frac{1.41 \times 10^{-2}\,M/s}{\underbrace{(0.0126)^2}_{M^2}\,\underbrace{(0.0125)^1}_{M}} = k$$

$$\boxed{7.11 \times 10^3\,M^{-2}\,s^{-1}}$$

(C) $7.12 \times 10^3\,M^{-2}\,s^{-1}$

$7.11 \times 10^3\,M^{-2}\,s^{-1}$

$\boxed{7.11 \times 10^3\,M^{-2}\,s^{-1}}$

(D) $Rate = 7.11 \times 10^3\,[0.0750]^2\,(0.0100)^1$

$Rate = 0.3999$

$Rate = 0.400\,M/s$

(E) $$\frac{\Delta[O_2]}{\Delta t} = \frac{\Delta[NO]}{\Delta t}\cdot\frac{1}{2}$$

$$\frac{\Delta[O_2]}{\Delta t} = \frac{\Delta[0.400]}{\Delta t} \times \frac{1}{2}$$

$$\frac{[O_2]}{\Delta t} = 0.200\,\frac{M}{s}$$