The average rate of the reaction
$N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$ over a certain period is reported as 1.15 mmol $NH_3 \cdot L^{-1} \cdot h^{-1}$.
What is the average rate over the same period in terms of the disappearance of H_2?

A) 0.58 mmol $H_2 \cdot L^{-1} \cdot h^{-1}$
B) 1.73 mmol $H_2 \cdot L^{-1} \cdot h^{-1}$
C) 3.45 mmol $H_2 \cdot L^{-1} \cdot h^{-1}$
D) None of the Above

What is the unique average rate?

A) 0.58 mmol$\cdot L^{-1} \cdot h^{-1}$
B) 1.15 mmol$\cdot L^{-1} \cdot h^{-1}$
C) 1.73 mmol$\cdot L^{-1} \cdot h^{-1}$
D) None of the Above

The reaction $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$ has the rate law of $k[SO_2][SO_3]^{-1/2}$.
What is the individual reaction order of SO_2 and SO_3 and what is the overall reaction order?

A) 1st with respect to SO_2 -1/2th with respect to SO_3 and 1/2th overall
B) 1st with respect to SO_2 -1/2th with respect to SO_3 and -1/2th overall
C) 1st with respect to SO_2 -1/2th with respect to SO_3 and 3/2th overall
D) None of the Above

When the NO concentration is doubled, the rate of the reaction $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$ increases by a factor of 4. When both the O_2 and the NO concentration are doubled, the rate increases by a factor of 8.

What is the reactant order for NO?

A) O^{th} B)1^{st} C)2^{nd} D)3^{rd} E) None of the Above

What is the reaction order of O_2?

A) O^{th} B)1^{st} C)2^{nd} D)3^{rd} E) None of the Above

What is the overall order of the reaction?

A) O^{th} B)1^{st} C)2^{nd} D)3^{rd} E) None of the Above

The highly toxic gas carbonyl chloride, $COCl_2$ (phosgene), is used to synthesis many organic compounds. Write the rate law and determine the value of k for the reaction used to produce carbonyl chloride

$CO(g) + Cl_2(g) \rightarrow COCl_2(g)$, given the following data collected at a certain temperature:

Experiment	CO ($mol \cdot L^{-1}$)	Cl_2 ($mol \cdot L^{-1}$)	Initial Rate (mol $COCl_2 \cdot L^{-1} \cdot s^{-1}$)
1	0.12	0.20	0.121
2	0.24	0.20	0.241
3	0.24	0.40	0.682

A) 5.40 $L \cdot mol^{-1} \cdot s^{-1}$

B) 11.27 $L \cdot mol^{-1} \cdot s^{-1}$

C) 25.21 $L^2 \cdot mol^{-2} \cdot s^{-1}$

D) None of the Above

Calculate the concentration of N_2O after the first order decomposition $2N_2O(g) \rightarrow 2N_2(g) + O_2(g)$

rate of decomposition of $N_2O = k[N_2O]$

The reaction has continued at 780ºC for 100 ms, and the initial concentration of N_2O was 0.20 $mol \cdot L^{-1}$ and $k = 3.4\ s^{-1}$.

A) $4.37 \times 10^{-149}\ mol \cdot L^{-1}$

B) $0.14\ mol \cdot L^{-1}$

C) $0.28\ mol \cdot L^{-1}$

D) None of the Above

Soil at the Rocky Flats Nuclear Processing Facility in Colorado was found to be contaminated with radioactive plutonium-239, which has a half life of 2.4×10^4 years. The soil was loaded into drums for storage. How many years must pass before the radioactivity drops to 20% of its initial value?

A) 4.65×10^{-5} y
B) 7.72×10^3 y
C) 5.57×10^4 y
D) None of the Above

The proposed two-step mechanism for a reaction is $H_2A + B \leftrightarrows BH^+ + HA^-$, which are fast, followed by $HA^- + B \rightarrow BH^+ + A^{2-}$, which is slow. Find the rate law with HA^- treated as the intermediate.

A) $k_1' \cdot k_2 \cdot k_1^{-1} \cdot [BH^+] \cdot [H_2A]^{-1}$
B) $k_2 \cdot [HA^-] \cdot [B]$
C) $k_1 \cdot k_2 \cdot k_1'^{-1} \cdot [H_2A] \cdot [B]^2 \cdot [BH^+]^{-1}$
D) None of the Above

The rate constant for the second-order gas-phase reaction $HO(g) + H_2(g) \rightarrow H_2O(g) + H(g)$ varies with the temperature as shown here:

Temperature (°C)	k ($L \cdot mol^{-1} \cdot s^{-1}$)
100	1.1×10^{-9}
200	1.8×10^{-8}
300	1.2×10^{-7}
400	4.4×10^{-7}

Determine the activation energy

A) 2.44×10^{-5} $J \cdot mol^{-1}$
B) 3.95×10^{3} $J \cdot mol^{-1}$
C) 4.10×10^{4} $J \cdot mol^{-1}$
D) None of the Above