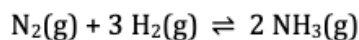


1.

If the rate of formation of NH_3 under a given set of conditions is 0.35 M/s , then what is the rate of disappearance of H_2 under the same conditions?



- A) 0.23 M/s
- B) 0.35 M/s
- C) 0.53 M/s
- D) 0.70 M/s
- E) 1.1 M/s

2.

A first-order reaction is 38.5% complete in 520 s. What is the value of the rate constant?

- A) $1.83 \times 10^{-3} \text{ s}^{-1}$
- B) $9.35 \times 10^{-4} \text{ s}^{-1}$
- C) $3.07 \times 10^{-3} \text{ s}^{-1}$
- D) $1.18 \times 10^{-3} \text{ s}^{-1}$
- E) $1.20 \times 10^{-3} \text{ s}^{-1}$

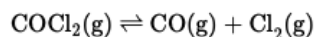
3.

Data collected in a laboratory experiment was used to create a graph of $\ln k$ versus $1/T$ (T in Kelvin). The slope of the resulting line is m . Which answer option represents the activation energy for the reaction used to collect the data?

- A) E_a/R
- B) $-E_a/R$
- C) mR
- D) $-mR$
- E) $\ln A$

4.

Phosgene, COCl_2 , was used as a chemical weapon during World War I and is currently used as a starting material for the synthesis of other chemical compounds. Phosgene decomposes into carbon monoxide and chlorine gas.

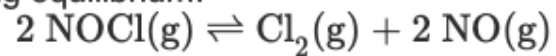


Suppose that 0.250 mol COCl_2 decomposes in a sealed 1.00 L container at 1000 K to give 0.0294 mol CO at equilibrium.

- a. Determine the equilibrium constant for the decomposition of phosgene at 1000 K .

5.

Consider the following equilibrium:



Determine the relative values of Q and K when the following changes are made to the system, and determine the direction in which the reaction shifts after these changes are made:

- a. Increasing the concentration of Cl_2
- b. Decreasing the concentration of NO
- c. Removing NOCl from the system