Question 1

The compound AX_2 decomposes according to the equation, $2AX_2(g) \rightarrow 2AX(g) + X_2(g)$. In one experiment, $[AX_2]$ was measured at various times and the following data were obtained. Based on this data, the average rate over the entire experiment is:

Time (s)	$[AX_2]$ (mol/L)
0	0.0500
2.0	0.0448
6.0	0.0300
8.0	0.0249
10.0	0.0209
20.0	0.0088

A) 1.0×10^{-3} mol/L·s

B) -1.0×10^{-3} mol/L·s

C) -2.1×10^{-3} mol/L·s

D) 6.87×10^{-3} mol/L·s

E) 3.43×10^{-3} mol/L·s

Question 2

The rate law for the general reaction

$aA + bB + ... \rightarrow cC + dD ...$ is

$$\text{Rate} = k[A]^m[B]^n...,$$

where the exponents m and n represent the partial orders with respect to the reactants. If the reaction is first order in A and second order in B, and time is measured in minutes

(min), what are the units for k?

A) mol/L·min

B) L·min/mol

C) L^2 /mol^2·min

D) min/mol^2·L^2

E) mol^2/L^2·min

Question 3

Which of the following changes would result in the rate decreasing by a factor of 4?

A) A reaction is first order with respect to reactant A, and [A] is doubled.

B) A reaction is second order with respect to reactant B, and [B] is halved.

C) A reaction is second order with respect to reactant C, and [C] is tripled.

Question 4

Given the the following rate law, what are the partial orders with respect to HNO_2 and NO and the overall reaction order (in that sequence) for :

$$\text{Rate} = k[HNO_2]^4/[NO]^2 \ .$$

A) 2, 0, 6

B) 4, 2, 6

C) 4, 2, 2

D) 4, -2, 2

E) 2, -2, 0

Question 5

What is the partial order with respect to A for the reaction having the experimental data below?

Concentrations are initial concentrations in mol/L and the rate given is initial rate in mol/L·min.

$$4A(g) + 3B(g) \rightarrow 2C(g)$$

Exp.	[A] (mol/L)	[B] (mol/L)	Init.Rate (M/min)
1	0.100	0.100	5.00
2	0.300	0.100	45.0
3	0.100	0.200	10.0
4	0.300	0.200	90.0

A) 0 B) ½ C) 1 D) 2 E) 3

Question 6

Which of the following sets of units corresponds to a rate constant for an overall reaction rate order of 1/2?

A) mol/L s

B) yr^{-1}

C) $(mol/L)^{1/2}\ s^{-1}$

D) $(mol/L)^{-5/2}\ min^{-1}$

Question 7

What is the order in reactant if a plot of the natural logarithm of [reactant] vs. time is linear?

A) 0

B) 1

C) 2

D) 1/2

E) -2

Question 8

A decomposition reaction has a rate constant of 0.0012 y^{-1}. How long does it take for [reactant] to reach 12.5% of its original value?

A) 5.8×10^2 yr

B) 72.5 yr

C) 1.32×10^3 yr

D) 193 yr

E) 1.7×10^3 yr

Question 9

The rate constant of a reaction is $4.7 \times 10^{-3}\ s^{-1}$ at 25 ºC, and the activation energy is 33.6 kJ/mol. What is the value of k at 75 ºC?

A) $3.3 \times 10^{-2}\ s^{-1}$

B) $9.17 \times 10^{-3}\ s^{-1}$

C) $2.99 \times 10^{44}\ s^{-1}$

D) $4.30 \times 10^{7}\ s^{-1}$

E) $7.46 \times 10^{-50}\ s^{-1}$

Question 10

Aqua regia, a mixture of hydrochloric and nitric acids, has been used since alchemical times as a solvent for many metals, including gold. Its orange color is due to the presence of nitrosyl chloride. Consider this one-step gaseous reaction for the formation of this compound:

$$NO(g) + Cl_2(g) \rightarrow NOCl(g) + Cl(g)$$

If ΔH^0 = 83 kJ/mol and $E_{a(fwd)}$ is 86 kJ/mol, calculate $E_{a(rev)}$.

A) 169 kJ
B) -86 kJ
C) 3 kJ
D) 83 kJ
E) -83 kJ

Question 11

The rate of disappearance of a reactant

A) decreases with time.
B) increases with time.
C) stays the same throughout the reaction.

Question 12

$$N_2\,(g) + 3\,H_2\,(g) \rightleftarrows 2\,NH_3\,(g)$$

The rate at which ammonia is formed is _____ that of the rate at which nitrogen is consumed.

A) the same

B) two times

C) half

D) three times

Question 13

The value of a rate

A) is always negative.
B) is always positive.
C) can be either positive or negative.

Question 14

Based on the following rate law, which of the following statements is true: Rate = $k[A]^2[B]$

A) The reaction is first order in A, second order in B, and third order overall.

B) The reaction is second order in A, first order in B, and second order overall.

C) The reaction is second order in A, first order in B, and third order overall.

D) The reaction is first order in A, second order in B, and second order overall.

Question 15

Based on the following rate law: Rate = $k[A]^2[B]$, what will be the effect on the rate if the concentration of A is doubled and the concentration of B is tripled?

A) The rate will increase by a factor of 18.

B) The rate will increase by a factor of 12.

C) The rate will increase by a factor of 6.

D) The rate will increase by a factor of 4.

Question 16

For a first order reaction, the plot of ln [A] versus time can be characterized as

A) a curve.

B) a straight line with a negative slope.

C) a straight line with a positive slope.

Question 17

After three half lives, what percentage of the initial reactant remains in a first-order decay?

A) 6.25

B) 12.5

C) 25

D) 50

Question 18

In the reaction mechanism below, ___ is the catalyst and ___ is the intermediate, respectively.

$$Cl + O_3 \rightarrow ClO + O_2$$

$$O + ClO \rightarrow Cl + O_2$$

A) ClO, Cl

B) Cl, ClO

C) O_2, Cl

Question 19

The rate constant for a reaction is 4.65 $Lmol^{-1}s^{-1}$. What is the overall order of the reaction?

A) zero

B) first

C) second

D) third

E) More information is needed to determine the overall order.

Question 20

At 298 K, if the activation energy of a reaction decreases by 10.0 kJ/mol, from 100.0 to 90.0 kJ/mol, what effect will this have on the rate of reaction?

A) The rate will increase by a factor of >50.

B) The rate will decrease by a factor of >50.

C) The rate will increase by a factor of <50.

D) The rate will decrease by a factor of <50.

E) The rate will not change unless temperature changes.

Answer Key – Chapter 14

1. B
2. C
3. B
4. D
5. D
6. C
7. B
8. E
9. A
10. C
11. A
12. B
13. B
14. C
15. B
16. B
17. B
18. B
19. C
20. A