Name: _____ Class: _____ Date: _____ ID: A

AP Chemistry Chapter 12 Practice Exam KEY

A 1. The average rate of disappearance of ozone in the reaction $2O_3(g) \rightarrow 3O_2(g)$ is found to be 7.25×10^{-3} atm over a certain interval of time. What is the rate of appearance of O_2 during this interval?

$7.25\times10^{-3}\ \frac{atm\ O_3}{2\ O_3} \left|\ 3\ O_2 = 1.08\times10^{-2}\right.$

A) 10.9×10^{-3} atm/s
B) 7.25×10^{-3} atm/s
C) 4.83×10^{-3} atm/s
D) 191×10^{-3} atm/s
E) 17.5×10^{-3} atm/s

C 2. For a reaction in which A and B react to form C, the following initial rate data were obtained:

[A] 1 (mol/L)	[B] 2 (mol/L)	Initial Rate of Formation of C (mol/L·s)
0.10	0.10	1.00
0.10	0.20	4.00
0.20	0.20	8.00

What is the rate law?
A) Rate = k[A][B]
B) Rate = k[A]^2[B]
C) Rate = k[A][B]^2
D) Rate = k[A]^2[B]^2
E) Rate = k[A]^3

The following questions refer to the reaction between nitric oxide and hydrogen

$$2NO + H_2 \rightarrow N_2O + H_2O$$

Experiment	Initial [NO], M (2)	Initial [H_2], M (1)	Initial Rate of Disappearance of NO (mol/L sec)
1	6.4×10^{-3}	2.2×10^{-3}	2.7×10^{-5}
2	12.8×10^{-3}	2.2×10^{-3}	1.1×10^{-4}
3	6.4×10^{-3}	4.5×10^{-3}	5.4×10^{-5}

___ 3. What is the rate law for this reaction?
A) Rate = k[NO]
B) Rate = k[NO]^2
C) Rate = k[NO]^2[H_2]
D) Rate = k[NO][H_2]
E) Rate = k[N_2O][H_2O]

Name: _____ ID: A

E 4. What is the magnitude of the rate constant for this reaction?

A) 0.66
B) 4.2×10^{-3}
C) 870
D) 1.9
E) 300

rate = $K[NO]^2[H_2]$

$2.70 \times 10^{-5} = K[6.4 \times 10^{-3}]^2[2.2 \times 10^{-3}]$

$K = 299$

B 5. What are the units for the rate constant for this reaction?

A) L/mol·s
B) $L^2/mol^2 \cdot s$
C) mol/L·s
D) s^{-2}
E) L^{-2}

$\frac{M}{s} = K\frac{M^2}{}\frac{M}{}$ $\quad \frac{M}{s} = K\frac{M^3}{s^3}$ $\quad \frac{M}{s M^3} = \frac{}{M^2 s} = \frac{L^2}{mol^2 \cdot s}$

A 6. What is the order of this reaction?

A) 3
B) 2
C) 1
D) 0
E) cannot be determined from the data

A 7. The reaction

$A \rightarrow B + C$

is second order in A. When $[A]_0 = 0.100\ M$, the reaction is 20.0% complete in 43.2 minutes. Calculate the half-life for the reaction.

A) 1.73×10^2 min
B) 10.8 min
C) 2.16×10^4 min
D) 7.68 min
E) none of these

80% left

$.80(.100) = .080$

$t_{1/2} = \frac{1}{K[A_0]}$

$\frac{1}{A_t} = Kt + \frac{1}{A_0}$

$\frac{1}{.080} = K(43.2) + \frac{1}{.100}$

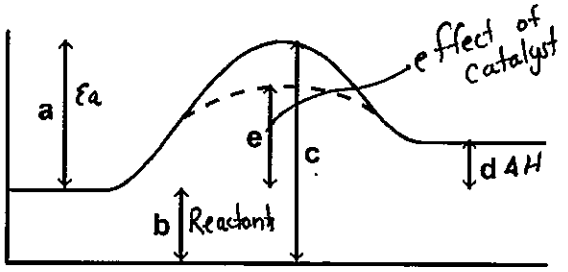
$K = .05797$

$t_{1/2} = \frac{1}{.05797(.100)}$

$t_{1/2} = 172.7$

Name: _____ ID: A

Use the potential energy diagram shown to answer the following:



A 8. Which letter shows the activation energy (without use of a catalyst)?
A) a
B) b
C) c
D) d
E) e

D 9. Which letter shows the change in energy for the overall reaction?
A) a
B) b
C) c
D) d
E) e

E 10. Which letter shows the activation energy using a catalyst?
A) a
B) b
C) c
D) d
E) e

C 11. The catalyzed pathway in a reaction mechanism has a _____ activation energy and thus causes a _____ reaction rate.
A) higher, lower
B) higher, higher
C) lower, higher
D) lower, steady
E) higher, steady

D 12. The reaction $3A + 4B \rightarrow$ products is second order in A and second order in B. What is the overall order of the reaction? $[A]^2[B]^2$
A) 0
B) 7
C) 2
D) 4
E) 6

A 13. The reaction A → B + C is known to be zero order in A with a rate constant of 5.0×10^{-2} mol/L s at 25°C. An experiment was run at 25°C where $[A]_0 = 2.0 \times 10^{-3}$ *M*. After 5.0 minutes, the rate is

A) 5.0×10^{-2} mol/L·s
B) 2.5×10^{-2} mol/L·s
C) 1.3×10^{-2} mol/L·s
D) 2.0×10^{-3} mol/L·s
E) none of these

temp didn't change so K is same

B 14. A particular first-order reaction has a rate constant of 0.0107 s^{-1}. What is the half-life for this reaction?

A) 1.00 s
B) 64.6 s
C) 93.2 s
D) 0.0155 s
E) 0.0107 s

$t_{1/2} = \frac{\ln 2}{k}$ $\frac{.693}{.0107}$

D 15. The decomposition of ozone may occur through the two-step mechanism shown:

step 1 $O_3 \rightarrow O_2 + O$

step 2 $O_3 + O \rightarrow 2O_2$

The oxygen atom is considered to be a(n)
A) reactant
B) product
C) catalyst
D) reaction intermediate
E) activated complex

B 16. The rate law for a reaction is found to be Rate = $k[A]^2[B]$. Which of the following mechanisms gives this rate law?

I. $A + B \rightleftharpoons E$ (fast) $[A][B] > [A][B]^2$
$E + B \rightarrow C + D$ (slow) B
II. $A + B \rightleftharpoons E$ (fast) $[A]^2[B]$
$E + A \rightarrow C + D$ (slow)
III. $A + A \rightarrow E$ (slow). $[A]^2$
$E + B \rightarrow C + D$ (fast)

A) I
B) II
C) III
D) two of these
E) none of these

The following questions refer to the reaction $2A_2 + B_2 \rightarrow 2C$. The following mechanism has been proposed:

step 1 (very slow) $A_2 + B_2 \rightarrow R + C$
step 2 (slow) $A_2 + R \rightarrow C$

B 17. What is the molecularity of step 2?
A) unimolecular
B) bimolecular
C) termolecular
D) quadmolecular
E) molecularity cannot be determined

B 18. Which step is rate determining?
A) both steps
B) step 1
C) step 2
D) a step that is intermediate to step 1 and step 2
E) none of these

B 19. According to collision theory, the activated complex that forms in step 1 could have which of the following structures? (The dotted lines represent partial bonds.)

A)
R - - - - R
: :
C - - - - C

B)
A - - - - A
: :
B - - - - B

C)
A - - - - A
: :
R - - - - R

D)
B - - - - B
:
R - - - - R

E)
A - - - - A
: :
C - - - - C

C

20. According to the proposed mechanism, what should the overall rate law be?
    A) rate = $k[A_2]^2$
    B) rate = $k[A_2]$
    C) rate = $k[A_2][B_2]$
    D) rate = $k[A_2][R]$
    E) rate = $k[R]^2$

21. Which of the following statements is typically true for a catalyst?

    I. The concentration of the catalyst will go down as a reaction proceeds. X
    II. The catalyst provides a new pathway in the reaction mechanism. ✓
    III. The catalyst speeds up the reaction. ✓

    A) I only
    B) II only
    C) III only
    D) I and III
    E) II and III