## Chemistry 1B Chapter 14 Worksheet - Daley

Name $\qquad$

1) Consider the following reaction:

$$
3 \mathrm{~A} \rightarrow 2 \mathrm{~B}
$$

The average rate of appearance of $B$ is given by $\Delta[\mathrm{B}] / \Delta \mathrm{t}$. Comparing the rate of appearance of $B$ and the rate of disappearance of $A$, we get $\Delta[B] / \Delta t=$ $\times(-\Delta[\mathrm{A}] / \Delta \mathrm{t})$.
A) $+2 / 3$
B) +1
C) $-2 / 3$
D) $-3 / 2$
E) $+3 / 2$
2) Which substance in the reaction below either appears or disappears the fastest?
$4 \mathrm{NH}_{3}+7 \mathrm{O}_{2} \rightarrow 4 \mathrm{NO}_{2}+6 \mathrm{H}_{2} \mathrm{O}$
A) $\mathrm{O}_{2}$
B) $\mathrm{H}_{2} \mathrm{O}$
C) $\mathrm{NO}_{2}$
D) $\mathrm{NH}_{3}$
E) The rates of appearance/disappearance are the same for all of these.

The peroxydisulfate ion $\left(\mathrm{S}_{2} \mathrm{O}_{8}{ }^{2-}\right.$ ) reacts with the iodide ion in aqueous solution via the reaction:

$$
\mathrm{S}_{2} \mathrm{O}_{8}{ }^{2-}(\mathrm{aq})+3 \mathrm{I}^{-} \rightarrow 2 \mathrm{SO}_{4}(\mathrm{aq})+\mathrm{I3}^{-}(\mathrm{aq})
$$

An aqueous solution containing $0.050 \mathrm{Mof}_{2} \mathrm{O}_{8}{ }^{2-}$ ion and $0.072 \mathrm{M} \mathrm{of}^{-}$is prepared, and the progress of the reaction followed by measuring $\left[\mathrm{I}^{-}\right]$. The data obtained is given in the table below.

| Time (s) | 0 | 400 | 800 | 1200 | 1600 |
| :--- | :--- | :--- | :--- | :--- | :--- |
| $\left[\mathrm{I}^{-}\right](\mathrm{M})$ | 0.072 | 0.057 | 0.046 | 0.037 | 0.029 |

3) The average rate of disappearance of $\mathrm{I}^{-}$ between 400 s and 800 s is $\qquad$ M/s.
A) $2.6 \times 10^{-4}$
B) $2.8 \times 10^{-5}$
C) $1.4 \times 10^{-5}$
D) $3.6 \times 10^{4}$
E) $5.8 \times 10^{-5}$
4) The concentration of $\mathrm{S}_{2} \mathrm{O}_{8}{ }^{2-}$ remaining at 400 s is $\qquad$ M.
A) +0.045
B) +0.035
C) +0.057
D) +0.015
E) -0.007
5) A reaction was found to be second order in carbon monoxide concentration. The rate of the reaction $\qquad$ if the [CO] is doubled, with everything else kept the same.
A) remains unchanged
B) is reduced by a factor of 2 .
C) triples
D) increases by a factor of 4
E) doubles
6) If the rate law for the reaction

$$
2 \mathrm{~A}+3 \mathrm{~B} \rightarrow \text { products }
$$

is first order in A and second order in B, then the rate law is rate $=$ $\qquad$ —.
A) $k[A]^{2}[B] 3$
B) $k[A][B]^{2}$
C) $k[A][B]$
D) $k[A]^{2}[B]^{2}$
E) $k[A] 2[B]$
7) A reaction was found to be third order in $A$. Increasing the concentration of A by a factor of 3 will cause the reaction rate to

[^0]8) The following reaction occurs in aqueous solution:
$$
\mathrm{NH}_{4}^{+}(\mathrm{aq})+\mathrm{NO}_{2}^{-} \rightarrow \mathrm{N}_{2}(\mathrm{~g})+2
$$
$\mathrm{H}_{2} \mathrm{O}(\mathrm{l})$

The data below is obtained at $25^{\circ} \mathrm{C}$.

| $\left[\mathrm{NH}_{4}{ }^{+}\right](\mathrm{M})$ | $\left[\mathrm{NO}_{2}^{-}\right](\mathrm{M})$ | Initial rate (N |
| :---: | :---: | :---: |
| 0.0100 | 0.200 | $3.2 \times 10^{-6}$ |
| 0.0200 | 0.200 | $6.4 \times 10^{-}$ |

The order of the reaction in $\mathrm{NH}_{4}{ }^{+}$is
$\qquad$ —.
A) -2
B) -1
C) 0
D) +1
E) +2
9) The rate constant for a particular second-order reaction is $0.47 \mathrm{M}^{-1} \mathrm{~s}^{-1}$. If the initial concentration of reactant is $0.25 \mathrm{mołL}$, it takes $\qquad$ s for the concentration to decrease to 0.13 mołL.
A) 3.7
B) 1.7
C) 1.4
D) 0.13
E) 7.9
10) A first-order reaction has a rate constant of $0.33 \mathrm{~min}^{-1}$. It takes $\qquad$ min for the reactant concentration to decrease from 0.13 M to 0.088 M .
A) 0.85
B) 1.4
C) 1.2
D) 0.51
E) 0.13
11) The initial concentration of reactant in a first-order reaction is 0.27 M . The rate constant for the reaction is $0.75 \mathrm{~s}^{-1}$. What is the concentration (mołL) of reactant after 1.5 s ?
A) 1.7
B) 3.8
C) $8.8 \times 10^{-2}$
D) 0.135
E) $2.0 \times 10^{-2}$
12) The half-life of a first-order reaction is 13 min. If the initial concentration of reactant is 0.085 M , it takes $\qquad$ min for it to decrease to 0.055 M .
A) 11
B) 8.2
C) 3.6
D) 8.4
E) 0.048
13) A second-order reaction has a half-life of 18 s when the initial concentration of reactant is 0.71 M . The rate constant for this reaction is
$\qquad$ $\mathrm{M}-1_{\mathrm{S}}-1$.
A) $2.0 \times 10^{-2}$
B) $7.8 \times 10^{-2}$
C) 18
D) $3.8 \times 10^{-2}$
E) 1.3
14) The reaction below is first order in $\left[\mathrm{H}_{2} \mathrm{O}_{2}\right]$ :

$$
2 \mathrm{H}_{2} \mathrm{O}_{2}(\mathrm{l}) \rightarrow 2 \mathrm{H}_{2} \mathrm{O}(\mathrm{l})+\mathrm{O}_{2}(\mathrm{~g})
$$

A solution originally at $0.600 \mathrm{M} \mathrm{H}_{2} \mathrm{O}_{2}$ is found to be 0.075 M after 54 min . The half-life for this reaction is $\qquad$ min.
A) 18
B) 14
C) 54
D) 6.8
E) 28
15) Of the following, all are valid units for a reaction rate except $\qquad$ —.
A) $M / s$
B) mołhr
C) $\mathrm{g} / \mathrm{s}$
D) mołL
E) mołL-hr

The data in the table below were obtained for the reaction:

$$
2 \mathrm{ClO}_{2}(\mathrm{aq})+2 \mathrm{OH}^{-}(\mathrm{aq}) \rightarrow \mathrm{ClO}_{3}^{-}(\mathrm{aq})+
$$

$(\mathrm{aq})+\mathrm{H}_{2} \mathrm{O}(1)$ | Initial Rate |  |  |  |
| :---: | :--- | :--- | :--- |
| Experiment |  |  |  |
| Number | $\left[\mathrm{ClO}_{2}\right](\mathrm{M})$ | $\left[\mathrm{OH}^{-}\right](\mathrm{M})$ | $(\mathrm{M} / \mathrm{s})$ |
| 1 | 0.060 | 0.030 | 0.0248 |
| 2 | 0.020 | 0.030 | 0.00276 |
| 3 | 0.020 | 0.090 | 0.00828 |

16) What is the order of the reaction with respect to $\mathrm{ClO}_{2}$ ?
A) 2
B) 4
C) 3
D) 0
E) 1
17) What is the order of the reaction with respect to $\mathrm{OH}^{-}$?
A) 0
B) 1
C) 2
D) 3
E) 4
18) What is the magnitude of the rate constant for the reaction?
A) 713
B) $1.15 \times 104$
C) 230
D) 115
E) 4.6
19) The half-life of a first-order reaction
A) can be calculated from the reaction rate constant
B) does not depend on the initial reactant concentration
C) is constant
D) is the time necessary for the reactant concentration to drop to half its original value
E) All of the above are correct.
20) The reaction

$$
2 \mathrm{NO}_{2} \rightarrow 2 \mathrm{NO}+\mathrm{O}_{2}
$$

follows second-order kinetics. At $300^{\circ} \mathrm{C}$, $[\mathrm{N}$ $\mathrm{O}_{2}$ ] drops from $0.0100-$ to $0.00650-\mathrm{M}$ in 100 s . The rate constant for the reaction is

$$
\mathrm{M}^{-1} \mathrm{~S}_{\mathrm{S}}-1
$$

A) 0.096
B) 1.2
C) 0.65
D) 0.54
E) 0.81

The reaction $\mathrm{A} \rightarrow \mathrm{B}$ is first order in [A]. Consider the following data.

| Time (s) | 0 | 5 | 10 | 15 | 20 |
| :--- | :---: | :---: | :---: | :---: | :---: |
| $[\mathrm{~A}](\mathrm{M})$ | 0.20 | 0.14 | 0.10 | 0.071 | 0.050 |

22) The concentration of $A$ is $\qquad$ M after 40.0 s .
A) 1.2
B) 0.17
C) $3.5 \times 10^{-4}$
D) $1.2 \times 10^{-2}$
E) 0.025
23) The rate constant for this reaction is
$\qquad$ $\mathrm{s}-1$.
A) $4.0 \times 102$
B) $3.0 \times 10^{-2}$
C) 0.46
D) $6.9 \times 10^{-2}$
E) 14
24) As the temperature of a reaction is increased, the rate of the reaction increases because the

[^1]25) Of the following, $\qquad$ will lower the activation energy for a reaction.
A) adding a catalyst for the reaction
B) raising the temperature of the reaction
C) increasing the concentrations of reactants
D) removing products as the reaction proceeds
E) increasing the pressure
26) The rate law of the overall reaction
$$
A+B \rightarrow C
$$
is rate $=k[A]^{2}$. Which of the following will not increase the rate of the reaction?
A) adding a catalyst for the reaction
B) increasing the concentration of reactant B
C) increasing the temperature of the reaction
D) increasing the concentration of reactant A
E) All of these will increase the rate.
27) A catalyst can increase the rate of a reaction
A) by lowering the overall activation energy $\left(E_{a}\right)$ of the reaction
B) by providing an alternative pathway with a lower activation energy
C) by lowering the activation energy of the reverse reaction
D) by changing the value of the frequency factor (A)
E) All of these are ways that a catalyst might act to increase the rate of reaction.
28) The rate of a reaction depends on
A) collision orientation
B) collision energy
C) collision frequency
D) all of the above
E) none of the above
29) Which energy difference in the energy profile below corresponds to the activation energy for the forward reaction?


## Reaction pathway

A) $x$
B) $y$
C) $x+y$
D) $y-x$
E) $x-y$
30) In general, as temperature goes up, reaction rate $\qquad$ -.
A) stays the same if the reaction is first order
B) goes up if the reaction is exothermic
C) goes up regardless of whether the reaction is exothermic or endothermic
D) stays the same regardless of whether the reaction is exothermic or endothermic
E) goes up if the reaction is endothermic
31) $\mathrm{SO}_{2} \mathrm{Cl}_{2}$ decomposes in the gas phase by the reaction

$$
\mathrm{SO}_{2} \mathrm{Cl}_{2}(\mathrm{~g}) \rightarrow \mathrm{SO}_{2}(\mathrm{~g})+\mathrm{Cl}_{2}(\mathrm{~g})
$$

The reaction is first order in $\mathrm{SO}_{2} \mathrm{Cl}_{2}$ and the rate constant is $3.0 \times 10^{-6} \mathrm{~s}^{-1}$ at 600 K . A vessel is charged with 2.4 atm of $\mathrm{SO}_{2} \mathrm{Cl}_{2}$ at 600 K . The partial pressure of $\mathrm{SO}_{2} \mathrm{Cl}_{2}$ at $3.0 \times 105 \mathrm{~s}$ is $\qquad$ atm.
A) 2.2
B) $1.4 \times 10^{5}$
C) 0.76
D) 0.29
E) 0.98

## Answer Key

## Testname: CHAPTER 14 WORKSHEET

1) A

Page Ref: Sec. 14.2
2) $A$

Page Ref: Sec. 14.2
3) $B$

Page Ref: Sec. 14.2
4) A

Page Ref: Sec. 14.2
5) D

Page Ref: Sec. 14.3
6) $B$

Page Ref: Sec. 14.3
7) A

Page Ref: Sec. 14.3
8) D

Page Ref: Sec. 14.3
9) E

Page Ref: Sec. 14.4
10) C

Page Ref: Sec. 14.4
11) C

Page Ref: Sec. 14.4
12) B

Page Ref: Sec. 14.4
13) B

Page Ref: Sec. 14.4
14) A

Page Ref: Sec. 14.4
15) D

Page Ref: Sec. 14.2
16) A

Page Ref: Sec. 14.3
17) B

Page Ref: Sec. 14.3
18) C

Page Ref: Sec. 14.3
19) C

Page Ref: Sec. 14.3
20) E

Page Ref: Sec. 14.3
21) $D$

Page Ref: Sec. 14.4
22) $D$

Page Ref: Sec. 14.4
23) D

Page Ref: Sec. 14.4
24) C

Page Ref: Sec. 14.5
25) A

Page Ref: Sec. 14.7
26) B

Page Ref: Sec. 14.7
27) B

Page Ref: Sec. 14.7
28) D

Page Ref: Sec. 14.5
29) A

Page Ref: Sec. 14.5
30) C

Page Ref: Sec. 14.5
31) E

Page Ref: Sec. 14.4


[^0]:    A) increase by a factor of 27
    B) decrease by a factor of the cube root of 3
    C) increase by a factor of 9
    D) remain constant
    E) triple

[^1]:    A) reactant molecules collide more frequently with less energy per collision
    B) reactant molecules collide less frequently
    C) reactant molecules collide with greater energy per collision
    D) activation energy is lowered
    E) reactant molecules collide less frequently and with greater energy per collision

