Name_____

1) Consider the following reaction:

 $3A \rightarrow 2B$

The average rate of appearance of B is given by $\Delta[B]/\Delta t$. Comparing the rate of appearance of B and the rate of disappearance of A, we get $\Delta[B]/\Delta t =$

_____ × (-Δ[A]/Δt). 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?

$$4NH_3 + 7O_2 \rightarrow 4NO_2 + 6H_2O$$

A) O2

- B) H₂O
- C) NO₂
- D) NH3
- E) The rates of appearance / disappearance are the same for all of these.

The peroxydisulfate ion $(S_2O_8^{2-})$ *reacts with the iodide ion in aqueous solution via the reaction:*

$$S_2O_8^{2-}(aq) + 3I^- \rightarrow 2SO_4(aq) + I3^-(aq)$$

An aqueous solution containing 0.050 M of $S_2O_8^{2-}$ ion and 0.072 M of I⁻ is prepared, and the progress of the reaction followed by measuring [I⁻]. The data obtained is given in the table below.

Time (s)	0	400	800	1200	1600
[I ⁻] (M)	0.072	0.057	0.046	0.037	0.029

3) The average rate of disappearance of I[−] between 400 s and 800 s is _____ M/s.

A) 2.6	×	10-4
B) 2.8	×	10-5
C) 1.4	×	10-5

- D) 3.6 × 10⁴
- E) 5.8 × 10⁻⁵
- 4) The concentration of $S_2O_8^{2-}$ remaining at
 - 400 s is _____ M. A) +0.045
 - B) +0.035
 - C) +0.057
 - C) +0.00
 - D) +0.015 E) -0.007

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- 5) A reaction was found to be second order in carbon monoxide concentration. The rate of the reaction _______ 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

8) The following reaction occurs in aqueous solution:

 $\mathrm{NH_4^+}\;(\mathrm{aq})\;+\;\mathrm{NO_2^-}\;\rightarrow\mathrm{N_2}\;(\mathrm{g})\;+\;2$ H2O (l)

The data below is obtained at 25°C.

_	$[NH_4^+](M)$	[NO ₂ ⁻] (M)	Initial rate (N
	0.0100	0.200	3.2 × 10 ^{−3}
_	0.0200	0.200	6.4 × 10 ⁻¹

6) If the rate law for the reaction

2A	+ 3B	\rightarrow products
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is first order in A and second order in B, then

- the rate law is rate = _____. A) k[A]2[B]3B) k[A][B]2C) k[A][B]D) k[A]2[B]2E) k[A]2[B]2
- 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
 - 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

The order of the reaction in NH_4^+ is

	_•
A) –2	
B) –1	
C) 0	
D) +1	
E) +2	

9) The rate constant for a particular

second-order reaction is $0.47 \text{ M}^{-1}\text{s}^{-1}$. If the initial concentration of reactant is 0.25 molL, it takes ______ s for the concentration to decrease to 0.13 molL.

- A) 3.7
- B) 1.7
- C) 1.4
- D) 0.13
- E) 7.9

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10) A first-order reaction has a rate constant of

0.33 min⁻¹. It takes _____ 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 s⁻¹. What is the concentration (mołL) of reactant after 1.5 s?

- A) 1.7B) 3.8
- C) 8.8 × 10⁻² D) 0.135 E) 2.0 × 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 _____ 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
 - $\begin{array}{c} & M^{-1}s^{-1}. \\ \hline A) \ 2.0 \ \times \ 10^{-2} \\ \hline B) \ 7.8 \ \times \ 10^{-2} \\ \hline C) \ 18 \\ \hline D) \ 3.8 \ \times \ 10^{-2} \\ \hline E) \ 1.3 \end{array}$

14) The reaction below is first order in [H₂O₂]:

 $2H_2O_2(l) \rightarrow 2H_2O(l) + O_2(g)$

A solution originally at 0.600 M H₂O₂ is found to be 0.075 M after 54 min. The half-life for this reaction is _____ 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 _____.

- A) M/s
- B) mołhr
- C) g/s
- D) mołL
- E) mołL**-**hr

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

$$2 \operatorname{ClO}_2(\operatorname{aq}) + 2 \operatorname{OH}^-(\operatorname{aq}) \rightarrow \operatorname{ClO}_3^-(\operatorname{aq}) + \operatorname{ClO}_2^-(\operatorname{aq}) + \operatorname{H}_2O(1)$$

Experiment			Initial Rate
Number	[ClO ₂] (M)	[OH ⁻] (M)	(M/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 ClO₂?

A)	2
B)	4
C)	3

- D) 0
- E) 1

17)	What is the order of the reaction with respect
	to OH ⁻ ?

- A) 0
 B) 1
 C) 2
 D) 3
- E) 4

18)	What is the overal	ll order of the reaction?	
	A) 0		

- B) 1
- C) 3
- D) 2
- E) 4

- 19) What is the magnitude of the rate constant for the reaction?
 - A) 713
 - B) 1.15 × 104
 - C) 230
 - D) 115
 - E) 4.6

20) 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.
- 21) The reaction
 - $2NO_2 \rightarrow 2NO + O_2$

follows second-order kinetics. At 300°C, [N O_2] drops from 0.0100- to 0.00650-M in 100 s. The rate constant for the reaction is

M-1s-1.	
A) 0.096	
B) 1.2	
C) 0.65	
D) 0.54	
E) 0.81	

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

Time (s)	0	5	10	15	20
[A] (M)	0.20	0.14	0.10	0.071	0.050

- 22) The concentration of A is _____ M after 40.0 s.
 A) 1.2
 B) 0.17
 C) 3.5 × 10⁻⁴
 D) 1.2 × 10⁻²
 E) 0.025
- 23) The rate constant for this reaction is
 - s⁻¹. A) 4.0 × 102 B) 3.0 × 10⁻² C) 0.46 D) 6.9 × 10⁻² E) 14
- 24) As the temperature of a reaction is increased, the rate of the reaction increases because the
 - 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 <u>and</u> with greater energy per collision

- 25) Of the following, _____ 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 <u>not</u> 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 (E_a) 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.

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- 28) The rate of a reaction depends on
 - A) collision orientation
 - B) collision energy
 - C) collision frequency
 - D) all of the above

A) x
B) y
C) x + y
D) y - x
E) x - y

- E) none of the above
- 29) Which energy difference in the energy profile below corresponds to the activation energy for the forward reaction?



31) SO₂Cl₂ decomposes in the gas phase by the reaction

$$SO_2Cl_2(g) \rightarrow SO_2(g) + Cl_2(g)$$

The reaction is first order in SO₂Cl₂ and the

rate constant is $3.0 \times 10^{-6} \text{ s}^{-1}$ at 600 K. A vessel is charged with 2.4 atm of SO₂Cl₂ at 600 K. The partial pressure of SO₂Cl₂ at

3.0 × 105 s is _____ atm.

- A) 2.2
- B) 1.4 × 10⁵
- C) 0.76
- D) 0.29
- E) 0.98

- 30) In general, as temperature goes up, reaction rate _____.
 - 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

Answer Key Testname: CHAPTER 14 WORKSHEET

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