Exam

Name______________________________

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

1) Nitrogen dioxide decomposes to nitric oxide and oxygen via the reaction: 1) _______

$2NO_2 \rightarrow 2NO + O_2$

In a particular experiment at 300 °C, $[NO_2]$ drops from 0.0100 to 0.00650 M in 100 s. The rate of disappearance of NO_2 for this period is _________ M/s.

A) 0.35 B) 3.5×10^{-3} C) 3.5×10^{-5} D) 1.8×10^{-3} E) 7.0×10^{-3}

2) At elevated temperatures, dinitrogen pentoxide decomposes to nitrogen dioxide and oxygen: 2) _______

$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$

When the rate of formation of O_2 is 2.2×10^{-4} M/s, the rate of decomposition of N_2O_5 is _________ M/s.

A) 1.1×10^{-4} B) 4.4×10^{-4} C) 5.5×10^{-4} D) 2.2×10^{-4} E) 2.8×10^{-4}

3) The rate law of a reaction is rate = k[D][X]. The units of the rate constant are _________. 3) _______

A) L $mol^{-1}s^{-1}$

B) L^2 $mol^{-2}s^{-1}$

C) mol $L^{-1}s_{-2}$

D) mol^2 $L^{-2}s^{-1}$

E) mol $L^{-1}s^{-1}$

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

$A + B \rightarrow P$

Experiment Number	[A] (M)	[B] (M)	Initial Rate (M/s)
1	0.273	0.763	2.83
2	0.273	1.526	2.83
3	0.819	0.763	25.47

4) The rate law for this reaction is rate = _________. 4) _______

A) k[P] B) $k[A]^2[B]$ C) k[A][B] D) $k[A]^2[B]^2$ E) $k[A]^2$

5) The magnitude of the rate constant is _________. 5) _______

A) 42.0 B) 38.0 C) 0.278 D) 13.2 E) 2.21

6) The reaction 6) _______

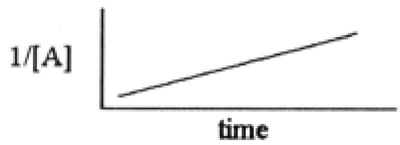
$2NO_2 \rightarrow 2NO + O_2$

follows second-order kinetics. At 300 °C, $[NO_2]$ drops from 0.0100 M to 0.00650 M in 100.0 s. The rate constant for the reaction is _________$M^{-1}s^{-1}$.

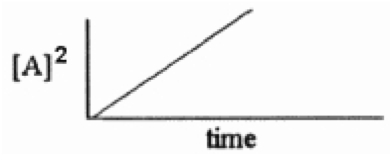
A) 0.54 B) 0.65 C) 0.81 D) 1.2 E) 0.096

7) Which one of the following graphs shows the correct relationship between concentration and time for a reaction that is second order in [A]? 7) _______

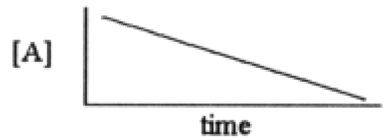
A)



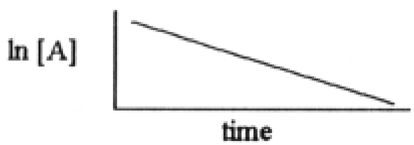
B)



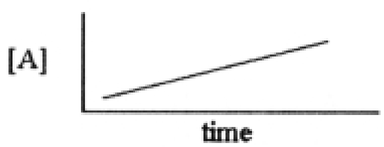
C)



D)



E)



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

time (s)	[A] (M)
0.0	1.60
10.0	0.40
20.0	0.10

8) The rate constant for this reaction is __________ s^{-1}. 8) _______

A) 3.0 B) 3.1×10^{-3} C) 0.013 D) 0.030 E) 0.14

9) The half-life of this reaction is __________ s. 9) _______

A) 0.97 B) 3.0 C) 5.0 D) 0.14 E) 7.1

10) A compound decomposes by a first-order process. If 25.0% of the compound decomposes in 60.0 minutes, the half-life of the compound is __________. 10) _______

A) 198 minutes
B) 145 minutes
C) 180 minutes
D) 120 minutes
E) 65 minutes

The reaction A → B *is first order in* [A]. *Consider the following data.*

Time (s)	0.0	5.0	10.0	15.0	20.0
[A] (M)	0.20	0.14	0.10	0.071	0.050

11) The rate constant for this reaction is __________ s^{-1}. 11) _______

A) 3.0×10^{-2} B) 14 C) 4.0×10^{2} D) 0.46 E) 6.9×10^{-2}

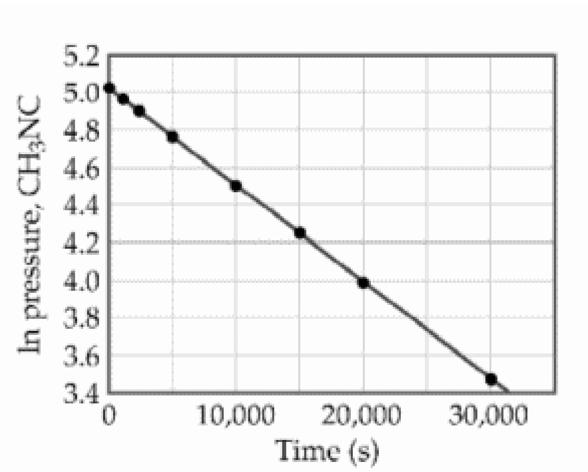
12) The concentration of A is __________ M after 40.0 s. 12) _______

A) 0.17 B) 3.5×10^{-4} C) 1.2 D) 1.3×10^{-2} E) 0.025

13) At elevated temperatures, methylisonitrile (CH_3NC) isomerizes to acetonitrile (CH_3CN): 13) _______

$$CH_3NC\,(g) \rightarrow CH_3CN\,(g)$$

The reaction is first order in methylisonitrile. The attached graph shows data for the reaction obtained at 198.9 °C.



The rate constant for the reaction is __________ s^{-1}.

A) $+1.9 \times 10^{4}$
B) +6.2
C) -1.9×10^{4}
D) -5.2×10^{-5}
E) $+5.2 \times 10^{-5}$

14) 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 __________. 14) _______

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

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

$A + B \rightarrow P$

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2	0.273	1.526	2.83
3	0.819	0.763	25.47

15) The order of the reaction in A is __________. 15) ______

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

16) The order of the reaction in B is __________. 16) ______

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

17) The overall order of the reaction is __________. 17) ______

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

18) A possible mechanism for the overall reaction 18) ______

$$Br_2\,(g) + 2NO\,(g) \rightarrow 2NOBr\,(g)$$

is

$$NO\,(g) + Br_2\,(g) \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} NOBr_2\,(g) \qquad \text{(fast)}$$

$$NOBr_2\,(g) + NO\,(g) \xrightarrow{k_2} 2NOBr \qquad \text{(slow)}$$

The rate law for formation of NOBr based on this mechanism is rate = __________.

A) $k_1[NO]^{1/2}$

B) $(k_1/k_{-1})^2[NO]^2$

C) $(k_2k_1/k_{-1})[NO]^2[Br_2]$

D) $k_1[Br_2]^{1/2}$

E) $(k_2k_1/k_{-1})[NO][Br_2]^2$