

Name \_\_\_\_\_

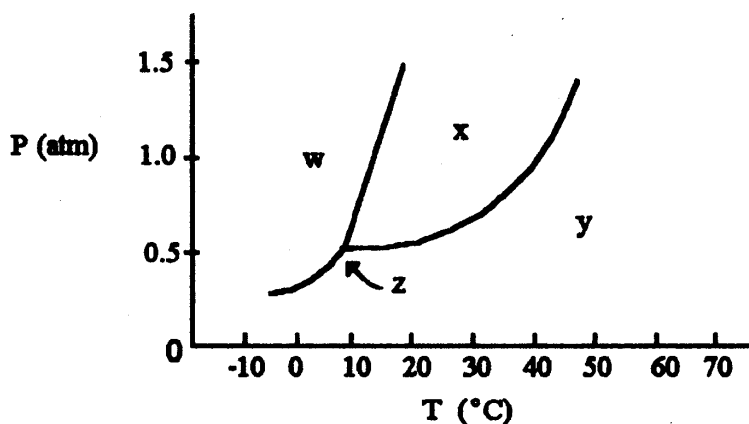
**MULTIPLE CHOICE.** Choose the one alternative that best completes the statement or answers the question.

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



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

- 1) The order of the reaction in A is \_\_\_\_\_.
- A) 1                      B) 2                      C) 3                      D) 4                      E) 0
- 2) The magnitude of the rate constant is \_\_\_\_\_.
- A) 0.278                  B) 38.0                  C) 2.21                  D) 42.0                  E) 13.2



- 3) The normal boiling point of the substance with the phase diagram shown above is \_\_\_\_\_ °C.
- A) 10                      B) 20                      C) 30                      D) 40                      E) 50
- 4) Of the following, \_\_\_\_\_ is an exothermic process.
- A) melting  
 B) boiling  
 C) subliming  
 D) freezing  
 E) All of the above are exothermic.

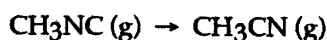
The peroxydisulfate ion ( $S_2O_8^{2-}$ ) reacts with the iodide ion in aqueous solution via the reaction:



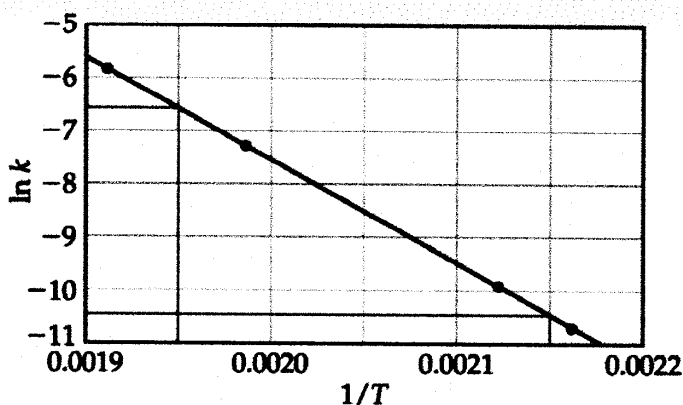
An aqueous solution containing 0.050 M of  $S_2O_8^{2-}$  ion and 0.072 M of  $I^-$  is prepared, and the progress of the reaction followed by measuring  $[I^-]$ . The data obtained is given in the table below.

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

- 5) The concentration of  $S_2O_8^{2-}$  remaining at 400 s is \_\_\_\_\_ M.  
 A) -0.007                      B) +0.057                      C) +0.035                      D) +0.015                      E) +0.045
- 6) A solution containing 10.0 g of an unknown liquid and 90.0 g water has a freezing point of  $-3.33^\circ\text{C}$ . Given  $K_f = 1.86^\circ\text{C}/m$  for water, the molar mass of the unknown liquid is \_\_\_\_\_ g/mol.  
 A) 161                      B) 69.0                      C) 333                      D) 619                      E) 62.1
- 7) In general, as temperature goes up, reaction rate \_\_\_\_\_.  
 A) stays the same regardless of whether the reaction is exothermic or endothermic  
 B) goes up if the reaction is exothermic  
 C) goes up if the reaction is endothermic  
 D) goes up regardless of whether the reaction is exothermic or endothermic  
 E) stays the same if the reaction is first order
- 8) At elevated temperatures, methylisonitrile ( $CH_3NC$ ) isomerizes to acetonitrile ( $CH_3CN$ ):



The dependence of the rate constant on temperature is studied and the graph below is prepared from the results.



The energy of activation of this reaction is \_\_\_\_\_ kJ/mol.

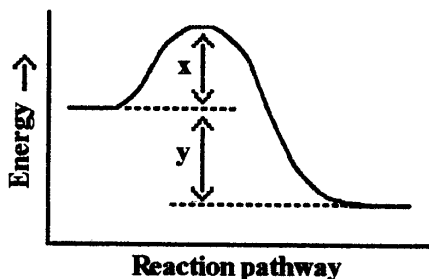
- A)  $4.4 \times 10^{-4}$                       B)  $1.6 \times 10^5$                       C) 160                      D)  $4.4 \times 10^{-7}$                       E)  $1.9 \times 10^4$
- 9) The most likely van't Hoff factor for an 0.01 m  $CaI_2$  solution is \_\_\_\_\_.  
 A) 3.29                      B) 3.00                      C) 2.69                      D) 1.00                      E) 1.27

- 10) The concentration of nitrogen in water is \_\_\_\_\_ M when the partial pressure of  $N_2$  above the solution is 0.826 atm. Henry's Law constant for this system is  $6.8 \times 10^{-4}$  mol/L-atm.
- A)  $1.2 \times 10^3$       B)  $8.2 \times 10^{-3}$       C) 0.43      D)  $5.6 \times 10^{-4}$       E) 5.6
- 11) A solution is prepared by dissolving 0.60 g of nicotine (a nonelectrolyte) in water to make 12 mL of solution. The osmotic pressure of the solution is 7.55 atm at 25°C. The molecular weight of nicotine is \_\_\_\_\_ g/mol.
- A) 50      B) 28      C) 43      D) 0.60      E) 160
- 12) 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) triples  
B) is reduced by a factor of 2.  
C) remains unchanged  
D) increases by a factor of 4  
E) doubles

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

- 13) The rate constant for this reaction is \_\_\_\_\_  $s^{-1}$ .
- A)  $3.1 \times 10^{-3}$       B) 0.013      C) 0.14      D) 3.0      E) 0.030
- 14) When argon is placed in a container of neon, the argon spontaneously disperses throughout the neon because \_\_\_\_\_.
- A) the dispersion of argon atoms produces an increase in disorder  
B) of the large attractive forces between argon and neon atoms  
C) of solvent-solute interactions  
D) of hydrogen bonding  
E) a decrease in energy occurs when the two mix
- 15) Which energy difference in the energy profile below corresponds to the activation energy for the forward reaction?



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

- 16) A solution is prepared by adding 30.00 g of lactose (milk sugar) to 110.0 g of water at 55°C. The partial pressure of water above the solution is \_\_\_\_\_ torr. The vapor pressure of pure water at 55°C is 118 torr. The MW of lactose is 342.3 g/mol.
- A) 94.1                      B) 92.7                      C) 116.3                      D) 169.4                      E) 1.670
- 17) Nitrogen dioxide decomposes to nitric oxide and oxygen via the reaction:
- $$2\text{NO}_2 \rightarrow 2\text{NO} + \text{O}_2$$
- In a particular experiment at 300°C,  $[\text{NO}_2]$  drops from 0.0100 to 0.00650 M in 100 s. The rate of appearance of  $\text{O}_2$  for this period is \_\_\_\_\_ M/s.
- A)  $3.5 \times 10^{-3}$                       B)  $1.8 \times 10^{-5}$                       C)  $7.0 \times 10^{-3}$                       D)  $3.5 \times 10^{-5}$                       E)  $7.0 \times 10^{-5}$
- 18) In the energy profile of a reaction, the species that exists at the maximum on the curve is called the \_\_\_\_\_.
- A) product  
B) activated complex  
C) activation energy  
D) atomic state  
E) enthalpy of reaction
- 19) When the phase diagram for a substance has a solid-liquid phase boundary line that has a negative slope (leans to the left), the substance \_\_\_\_\_.
- A) melts rather than sublimates under ordinary conditions  
B) sublimates rather than melts under ordinary conditions  
C) can go from solid to liquid, within a small temperature range, via the application of pressure  
D) cannot be liquefied above its triple point  
E) cannot go from solid to liquid by application of pressure at any temperature
- 20) Which one of the following substances would be the most soluble in  $\text{CCl}_4$ ?
- A)  $\text{CH}_3\text{CH}_2\text{OH}$                       B)  $\text{NaCl}$                       C)  $\text{NH}_3$                       D)  $\text{C}_{10}\text{H}_{22}$                       E)  $\text{H}_2\text{O}$
- 21) As the concentration of a solute in a solution increases, the freezing point of the solution \_\_\_\_\_ and the vapor pressure of the solution \_\_\_\_\_.
- A) increases, increases  
B) increases, decreases  
C) decreases, decreases  
D) decreases, is unaffected  
E) decreases, increases
- 22) Which one of the following concentration units varies with temperature?
- A) mole fraction  
B) molality  
C) mass percent  
D) molarity  
E) all of the above

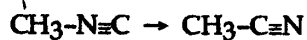
23) For a first-order reaction, a plot of \_\_\_\_\_ versus \_\_\_\_\_ is linear.

- A)  $\ln [A]_t$ ,  $\frac{1}{t}$       B)  $\frac{1}{[A]_t}$ ,  $t$       C)  $\ln [A]_t$ ,  $t$       D)  $t$ ,  $\frac{1}{[A]_t}$       E)  $[A]_t$ ,  $t$

24) CsCl crystallizes in a unit cell that contains a  $\text{Cs}^+$  ion at the center of a cube and a  $\text{Cl}^-$  ion at each corner. What is the total number of ions ( $\text{Cs}^+$  ions and  $\text{Cl}^-$  ions) that lie within a unit cell of CsCl?

- A) 4      B) 9      C) 2      D) 6      E) 5

25) The reaction



is a first-order reaction. At  $230.3^\circ\text{C}$ ,  $k = 6.29 \times 10^{-4} \text{ s}^{-1}$ . If  $[\text{CH}_3\text{-N}\equiv\text{C}]$  is  $1.00 \times 10^{-3}$  initially,  $[\text{CH}_3\text{-N}\equiv\text{C}]$  is \_\_\_\_\_ after  $1.000 \times 10^3 \text{ s}$ .

- A)  $5.33 \times 10^{-4}$       B)  $4.27 \times 10^{-3}$       C)  $2.34 \times 10^{-4}$       D)  $1.00 \times 10^{-6}$       E)  $1.88 \times 10^{-3}$

**Answer Key**

**Testname: EXAM2\_GREEN.TST**

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

- 1) B
- 2) B
- 3) D
- 4) D
- 5) E
- 6) E
- 7) D
- 8) C
- 9) C
- 10) D
- 11) E
- 12) D
- 13) C
- 14) A
- 15) A
- 16) C
- 17) B
- 18) B
- 19) C
- 20) D
- 21) C
- 22) D
- 23) C
- 24) C
- 25) A