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CHEMISTRY

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Chemical Kinetics



1. Total number of atoms, Ions or molecules of

the reactants involved in the reaction Is

termed as its_____.



2. The rate at which a substance reacts depends on its

A. Molecular weight

B. Atomic weight

C. Active mass

D. Atomic number

Answer:





3. In ____order reaction the rate of a reaction does not change with the concentration of the reactants.

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4. Increasing the temperature of an aqueous

solution will cause

A. Decrease in molarity

- B. Decrease In molality
- C. Decrease in mole fraction
- D. None of these

Answer:

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5. The reaction which is blomolecular but

order is one is called_____.

6. The time required for 100% completion of a

zero order reaction Is

A. 2a

- B. a/k
- $\mathsf{C}.\,k\,/\,2$
- D. 2a/k

Answer:

7. Which of these does not Influence the rate of reaction

A. Nature of the reactant

B. Temperature of the reactant

C. Concentration of the reactant

D. Molecularity of the reactant

Answer:

8. The fastest step in the reaction mechanism is called rate determining step". Check whether this statement is true or false ?



9. For the reaction $A + B \rightarrow C$, itls found that doubling the concentration of A Increases the rate by 4 times, and doubling the concentration of B doubles the reaction rate. What is the overall order of the reaction? A. 1

B. 3

C. 4

D. 0

Answer:

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10. In the Arrheniusequation, E represents

A. the	energy	below	W	hich	colliding
molecules will not react					
B. the	energy	above	W	hich	colliding
molecules will react.					
C. the	total e	energy	of	the	colliding
molecules.					
D. none of thes					

Answer:

11. Following graph is a plot of the rate of reaction concentration of the reactant. What is the order of the reaction.



12. Following graph is a plot . of the rate of reaction VS concentration of the reactant What is the order of the reaction?



13. Order of the photochemical reaction occurlng between Hydrogen and Chlorine is

A. first order

B. zero order

C. second order

D. third second

Answer:

14. Observe the relationship between the first two terms and fill in the blanks. First order reaction : s^{-1} Zero order reaction : ____



15. Choose the correctly matched pair.

A. Unimolecular

reaction

 $NH_4NO_2
ightarrow N_2 + 2H_2O$

B. Bimoiecular

reaction:

$2NO(g) + O_2 ightarrow 2NO_2(g)$

C. Trlmolecular

reaction:

$2HI(g) ightarrow H_2(g) + I_2(g)$

D.

Answer:

16. Identify the order of a reaction if the units

of its rate constant is L $mol^{-1}s^{-1}$

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17. What Is the rate of disappearance of hydrogen in the reaction ? $3H_2+N_2
ightarrow 2NH_3$

18. The temperature dependence of is expressed by Arrhenius equation. Watch Video Solution 19. The energy needed to form the intermediate called activated complex is known as

20. The number of collisions per second per unit volume of the reaction mixture is called_____.



21. Can we have reactions which proceed with

constant rate?



22. Instantaneous rate of reaction is preferred

to average rate. Why?

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23. Identity the graph (A or B), represents the

change in concentration of reactant with time.



24. In a class room discussion a student argues that average rate and instantaneous

rate are same.Do you agree with this

arguement? justify your answer.



25. In a class room discussion a student

argues that average rate and instantaneous

rate are same.Justify your answer

26. From the rate expression for the following reaction determine the order of reaction and dimensions of the rate constant. $3NO(g) \rightarrow N_2O(g) + NO_2(g),$ Rate= $K[NO]^2$.

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27. If half-life of a reaction Is directly proportional to Initial concentration of the reactant, what Is the order of the reaction?

28. Give a relation which connects rate constant with temperature.

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29. For first order reaction half-life period Is Independent of initial concentration and Inversely proportional to the rate constant.Give relation for the above In the case of zero order reaction.



30. For first order reaction half-life period Is Independent of initial concentration and Inversely proportional to the rate constant. The slope of the line in a graph of logK Vs $\frac{1}{T}$ for a reaction is -5841. Calculate energy of activation for this reaction. $[R = 8.314JK^{-1}mol^{-1}].$

31. A first order reaction is 20% complete in 10 min. Calculate the specific rate constant of the reaction.



32. A first order reaction is 20% complete in ten minutes. Calculate time taken for the reaction to go upto 75% completion.



33. Mention the factors that affect the rate of

a chemical reaction.



34. The rate constant for a first order reaction is 60 (s)⁽⁻¹⁾. How much time will it take to reduce the initial concentration of the reactant to its 1/16th value?

35. From the rate expression for the following reactions determine the order of reaction and the dimensions of the rate constant. $H_2O_{2(aq)} + 3I_{aq} + 2H^+ (aq) \rightarrow 2H_2O_R + I_3$ Rate =K[H_2O_2][I^-]

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36. From the rate expression for the following reactions determine the order of reaction and the dimensions of the rate constant.



the order of reaction?



38. 75% of a reaction of first order was completed in 64 minutes. When was its half completed?



39. Rate of a reaction is the change in concentration of reactant or product per unit time.what does the slope of the graph represent, variation In the concentration vs time for a zero order reaction?



40. For a reaction $A + B \rightarrow C + D$. The order with respect to A is 1 and that of B is 2. Write the rate law expression for the reaction.

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41. For a reaction $A + B \rightarrow C + D$. The order with respect to A is 1 and that of B is 2. How is the rate affected when the concentration of B Is trippled?

42. For a reaction $A + B \rightarrow C + D$. The order with respect to A is 1 and that of B is 2. How is the rate affected when the concentration of both A and B are doubled?



more yield of SO_3 , a catalyst L Is used. Draw a graph which conveys the fact that activation energy of a catalysed reaction Is different from that of an uncatalysed reaction.

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44. An archaeological substance contained wood had only 66.66% of C^{14} found in a tree. Calculate the age of the sample if the half life of C^{14} is 5730 years.

45. Identify theorder of each of the following reaction.For a reaction $A \rightarrow B$, the rate constant has the same unit as the rate of the reaction.

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46. Identify theorder of each of the following reaction.For a reaction X o Y, half-life of the reaction is independent of Initial concentration of X.



47. Identify the order of each of the following reaction. For a reaction $P \rightarrow Q$, the rate increases four times when the concentration of P is doubled.

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48. Some statements related to kinetic are given below. The number of reactant molecules

whose concentration changes can determine

the rate.



49. Some statements related to kinetic are given below. The order of a reaction may be a fraction.



50. Some statements related to kinetic are given below. In certain cases, the rate is independent of the concentration of the reactants Illustrate and substantiate the above statements.

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51. The rate equation of the reaction , xA + yB + 2C
ightarrow Products in given as Rate =

 $K[A]^{n}[B]^{m}$.Calculate the order of the reaction

with respect to A, B and C.



52. The rate equation of the reaction , xA + yB + 2C o Products in given as Rate = ${
m K}[A]^n [B]^m.$ Calculate the molecularity of the reaction.
53. The rate equation of the reaction , xA + yB + 2C o Products in given as Rate = ${
m K}[A]^n [B]^m.$ Calculate the overall order of the reaction.

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54. Decomposition of ammonia on metal surface is a zero order reaction. Give the rate law of this reaction.

55. Decomposition of ammonia on metal surface is a zero order reaction.Plot rate-concentration graph for this reaction.



56. Decomposition of ammonia on metal surface is a zero order reaction.Plot rate-concentration graph for this reaction.

57. The decomposition of N_2O_5 In CCI_4 solution has been studied by monitoring the concentration of N_2O_5 In the solution. Initially the concentration of N_2O_5 is 2.33 M and after 184 minutes, it Is reduced to 2.08 M. The reaction takes place according to the equation. $2N_2O_5 \rightarrow 4NO_2 + O_2$ Calculate the average rate of this reaction.

58. The decomposition of N_2O_5 In CCI_4 solution has been studied by monitoring the concentration of N_2O_5 In the solution. Initially the concentration of N_2O_5 is 2.33 M and after 184 minutes, it Is reduced to 2.08 M. The reaction takes place according to the equation. $2N_2O_5
ightarrow 4NO_2 + O_2$ What Is the rate of production NO_2 during this period?

59. Explain a pseudo order reaction with an example.

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60. Ammonia and Oxygen react at high temperature according to equation. $4NH_3(g) + 5O_{2(g)} \rightarrow 4NO(g) + 6H_2O(g)$ The rate of formation of NO = $4 \times 10^{-4} mol/L/S$. Calculate rate of disappearance of NH_3 .



61. Ammonia and Oxygen react at high temperature according to equation. $4NH_3(g) + 5O_2(g) \rightarrow 4NO(g) + 6H_2O(g)$ The rate of formation of NO = $4 \times 10^{-4} mol/L/S$. Calculate rate of formation of water.



62. Assign the order of the following reaction.

 $H_{2(g)+CI_{2(g)\,\overline{h}\overline{v}2HCI_g}}.$

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63. Derive theintegratedrateequation for the First order reaction and give the expression for half-life of reaction.

64. A reaction is second order with respect to a reactant. How is the rate of reaction affected if the concentration of the reactant Is reduced to half?



65. Identify the reaction order If the rate

constant Is $4 imes 10^{-5}Lmol^{-1}\,{
m sec}^{-1}$

66. For a reaction suppose the activation energy Is zero. What is the value of rate constant at 300 K ? If K is $1.6 \times 10^8 S^{-1}$ at 280 K $(R = 8.314 J K^{-1} mol^{-1}$.

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67. How will you differentiate between reaction

rate and rate constant ?

68. Graphically represent the dependence of half-life, and Initial concentration of reactant for a zero order and first order reaction.

69. Does molecularity has any meaning for a

complex reaction? Explain

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70. Can a reaction have zero activation energy?Watch Video Solution

71. "Activation energies are low for fast reaction and high for slow reactions" a) Justify the statement. b) The rate of a reaction quadruples when the temperature changes from 310 K to 330 K. Calculate the activation,



$$R=8.314 Jk^{-1} (mol)^{-1}$$

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72. "Activation energies are low for fast reaction and high for slow reactions" a) Justify the statement. b) The rate of a reaction quadruples when the temperature changes from 310 K to 330 K. Calculate the activation, energy of the reaction $R = 8.314 J k^{-1} (mol)^{-1}$



73. In a classroom discussion about order and moleculrity of a reaction,Ramu argued that "there are reactions which appear to be of higher order but actually follows first order kinetics"How far is his statement true? Give your opinion in this regard. Justify your answer using suitable example.

74. In a class room discussion about order and molecularity of a chemical reaction, Ramu argued that "there are reactions which appear to be of higher order but actually follow first order kinetics.List out any three Important differences between order and molecularity.



75. At a certain temperature, T K the endothermic reaction A o B proceeds

completely to the end. Determine sign of $\Delta G(+ ext{ or } -)$ for the reaction B o A at the temperature,T K.

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76. Enthalpy and Entropy changes of two reactions are given below: Find out whether they are spontaneous or not at $27^{o}C$. Justify. a) ΔH = 26 kJ/mole, ΔS = 8.3 J/K/mole b) ΔH = -393.4 kJ/mole, ΔS = 6 J/K/mole



77. Mention the factors that affect the rate of

a chemical reaction.



78. A reaction is second order with respect to a reactant. How is the rate of reaction affected. if the concentration of the reactant is (i) doubled



79. A reaction is second order with respect to a reactant. How is the rate of reaction affected if the concentration of the reactant Is reduced to half?

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80. A reaction is first order in A and second order in B.Write the differential rate equation

for the reaction.

81. A reaction is first order in A and second order in B. How isthe rate affected on increasing the concentration of B three times?



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82. A reaction is first order in A and second

order in B.How is the rate affected when the

concentration of both A and B is doubled?



83. Calculate the half-life of a first order reaction from their rate constants given below: i) $200(s)^{-1}$

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84. Calculate the half-life of a first order reaction from their rate constants given below. $2 \min^{-1}$

85. Calculate the half-life of a first order reaction from their rate constants given below. $4years^{-1}$.

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86. For a first order reaction, show that time required for 99 % completion is twice the time required for the completion of 90 % of reaction.

87. The rate constant for the decomposition of hydrocarbons is $2.418x10^{-5}(s)^{-1}$ at 546(~K). if the energy of activation is $179.9\frac{kJ}{mol}$, what wilt be the value of pre-exponential factor:



88. For a reaction $A + B \rightarrow C + D$, the rate equation is, Rate = $K[A]^{3/2}[B]^{1/2}$. Give the overall order and molecularity of reaction.

89. The temperature dependence of the rate of

a chemical reaction can be explained by

Arrhenius equation. Give Arrhenius equation.



90. The temperature dependence of the rate of a chemical reaction can be explained by Arrhenius equation.The rate of a chemical reaction doubles for an increase of 10 K in absolute temperature from 300 K. Calculate $R = 8.314 J K^{-1} mol^{-1}, \log 2 = 0.3010$].

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91. For the reaction, $2NO_{(g)}$ + $O_{2(g)}$ ightarrow $2NO_{2(g)}$ the rate law is given as. Rate =k $[NO]^2[O_2]$ The order of the reaction with respect to O_2 is _

92. The rate constant of a reaction at 293 K is $1.7 \times 10^5 s^{-1}$ When the temperature Is increased by 20.K, the rate constant Is increased to $2.57 \times 10^5 s^{-1}$. Calculate Ea and A of the reaction.

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93. Identify the order of reaction if the unit of

rate constant is $molL^{-1}S^{-1}$.

94. Plot a graph showing variation in the concentration of reactants against time for a zero order reaction.



95. What do you mean by zero order of a

reaction?

96. The initial concentration of the first order reaction, $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$ was $1.24 \times 10^{-2} mol L^{-1}$. The concentration of N2O5 after '1' hour was 0.20 x 10-2 mol L-1 Calculate the rate constant of the reaction at 300 K.



97. The molecularity of reaction $2NO+O_2
ightarrow 2NO_2$ is

B. 2

C. 3

D. 0

Answer:

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98. What do you mean by rate of a reaction?

99. What will be the effect of temperature on a

rate of a reaction?



100. A first order reaction is found to have a

rate constant, $k=5.5 imes 10^{-4}s^{-1}$.Find out

the half-life of the reaction.



101. The term order and molecularity are common in chemical kinetics. What do you mean by order and molecularity?



102. The term order and molecularity are common in chemical kinetics. Write two factor

influencing rate of a reaction

103. The term order and molecularity are common in chemical kinetics. Write Arrhenius equation.



104. Consider a general reaction $aA + bB \rightarrow cC + dD$ The rate expression for the reaction is Rate = $k[A]^x[B]^y$.Establish the significance of (a+b)and (x+y)term in terms of order and molecularity.



105. Consider a general reactionaA+bB
ightarrow cC+dD

The rate expression for the reaction is Rate = $k[A]^x[B]^y$.Write any two differences between order and molecularity.



106. 'Reaction with zero order is possible but

zero molecularity is not".Justify the statement.



107. For a general reaction A+B ightarrowProducts, rate law Is given as rate = $K[A][B]^2$.What is rate law?



108. For a general reaction $A + B \rightarrow$ Products, rate law Is given as rate = $K[A][B]^2$. What Is the unit of rate constant for the above reaction?

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109. For a general reaction $A + B \rightarrow$ Products, rate law Is given as rate = $K[A][B]^2$.Give any 2 differencesbetween order and molecularity of a reaction.





110. Zero order reaction means that the rate of a reaction is independent of the concentration of reactants. Write an example for a zero order reaction.

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111. Zero order reaction means that the rate of

a reaction is independent of the concentration





114. Consider the composition reaction given below. $2HI(g) \rightarrow H_2(g) + I_2(g)$. The rate of appearatance of hydrogen is equal to_____ times the rate of disappearance of HI.

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115. Consider the decomposition reaction given below. $2HI(g)
ightarrow H_2(g) + I_2(g)$. Write
the differential rate expression of this reaction

with respect of the reactant.



116. A first order reaction has a rate constant

 $1.15 imes 10^{-3} s^{-1}$. How long will 5 g of this

reactant take to reduce to 3 g?

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117. Rate of a reaction is the change in concentration of any one of the reactants or any one of the products in unit tim.Express the rate of the following reaction in terms of reactants and products $2NO(g) + O_{2(G)} \rightarrow 2NO_{2(G)}$

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118. Rate of a reaction is the change in concentration of any one of the reactant or

any one of the products in unit time. $N_2O_{5(g) \rightarrow 2NO(2(g) + O_{2(g)})}$ is a first order

recation find the unit of K.

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119. By deriving the equation for $t_{1/2}$ of first order reaction . Prove that $t_{1/2}$ is independent

of initial concentration of its reacting spectes.

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120. The conversion of molecule A to B follows second order kinetics its rate equation for the second order reaction is rate = `K[A]^2.If the concentration of A is increased to 4 times how will it affect the formation of B.



121. The conversion of molecule A to B follows second order kinetics. Indicate the order and

molecularity of the reaction given below: $C_{12}H_{22}O_{11} + H_2O \xrightarrow{H} C_6H_{12}O_6 + C_6H_{12}O_6$

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