



CHEMISTRY

BOOKS - A N EXCEL PUBLICATION

CHEMICAL KINETICS

Question Bank

1. For the reaction $R \rightarrow P$, the concentration of a reactant change from 0.03 M to 0.02M in

25 minutes. Calculate the average rate of reaction using units of time and seconds.



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2. In a reaction $2A \rightarrow$ product, the concentration of A decreases from 0.5 mol L^{-1} to 0.4 mol L^{-1} in 10 minutes. Calculate the rate during this interval.



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3. For a $A + B \rightarrow \text{product}$, the rate law is given by $r = k[A]^{\frac{1}{2}}[B]^2$. What is the order of the reaction .



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4. The conversion of molecules of X to Y follows second order kinetics. If concentration of X is increases to three how will it affect the rate of formation of Y?



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5. A first order reaction has a rate constant $1.15 \times 10^{-3} \text{ s}^{-1}$. How long will 5 g of this reactant take to reduce to 3 g?



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6. Time required to decompose SO_2Cl_2 to half of its initial amount is 60 minutes. If the decomposition is a first order reaction, calculate the rate constant of the reaction.



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7. What will be the effect of temperature on rate constant?



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8. The rate of a chemical reaction doubles for an increases of 10 K in absolute temperature from 298 K. Calculate E_e .



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9. The activation energy for the reaction, $2HI(g) \rightarrow H_2(g) + I_2(g)$ is $209.5 \text{ kJ mol}^{-1}$ at 581 K. Calculate the fraction of molecules of reactant having energy equal to or greater than activation energy.



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10. The order of a chemical reaction can be zero and even a fraction but molecularity cannot be zero or a non-integer. What do you mean by the order of a reaction ?



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11. The order of a chemical reaction can be zero and even a fraction but molecularity cannot be zero or a non-integer. What is molecularity of a reaction?



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12. The conversion of molecules of X to Y follows second order kinetics. If concentration

of X is increases to three how will it affect the rate of formation of Y?



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13. In a classroom discussion about order and molecularity 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.



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14. List out any three important differences between order and molecularity.



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15. The hydrolysis of an ester in acid medium is first order reaction. What do you mean by a first order reaction ?



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16. Write the relation between half life $t_{\frac{1}{2}}$ and rate constant (k) of a first order reaction .



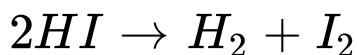
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17. The hydrolysis of an ester in acid medium is first order reaction. Half life period of a first order reaction is 20 seconds. How much time will it take to complete 90% of the reaction?



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18. Rate of a reaction is the change in concentration of any one of the reactants or any one of the products in unit time. Express the rate of the following reaction in terms of reactants and products:



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19. Rate of a reaction is the change in concentration of any one of the reactants or any one of the products in unit time. If rate

expression for the above reaction is $\text{rate} = k(HI)^2$, what is the order of the reaction?



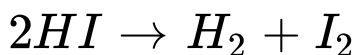
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20. Rate of a reaction is the change in concentration of any one of the reactants or any one of the products in unit time. Define order of a reaction.



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21. Rate of a reaction is the change in concentration of any one of the reactants or any one of the products in unit time.



Whether the molecularity and the order of the above reaction are the same? Give reason.



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22. For a first order reaction half life period

$t\left(\frac{1}{2}\right)$ is independent of initial concentration

of its reacting species. What is meant by half life period of a reaction?



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23. For a first order reaction half life period $t\left(\frac{1}{2}\right)$ is independent of initial concentration of its reacting species. By deriving the equation for $t\left(\frac{1}{2}\right)$ of first order reaction, prove that $t_{\frac{1}{2}}$ is independent of initial concentration of its reacting species.



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24. 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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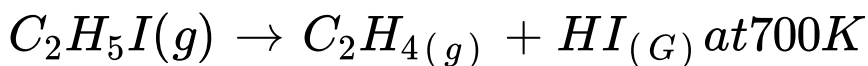
25. Zero order reaction means that the rate of a reaction is independent of the concentration

of reactants. Write the integral rate expression for the zero order reaction, $R \rightarrow P$



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26. The temperature dependence of the rate of a chemical reaction can be accurately explained by Arrhenius equation. With the help of Arrhenius equation, calculate the rate constant for the first order reaction



.Energy of activation (E_a) for the reaction is

209 kJ mol^{-1} and rate constant at 600K is $1.60 \times 10^{-5} \text{ s}^{-1}$ [Universal gas constant $R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$]



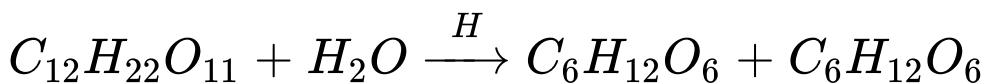
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27. The conversion of molecules of X to Y follows second order kinetics. If concentration of X is increases to three how will it affect the rate of formation of Y?



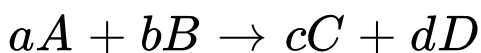
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28. The conversion of molecule A to B follows second order kinetics. Indicate the order and molecularity of the reaction given below:



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29. Consider a general reaction



The rate expression for the reaction is Rate =

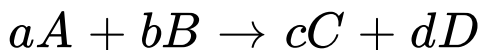
$k[A]^x[B]^y$. Establish the significance of

$(a+b)$ and $(x+y)$ term in terms of order and molecularity.



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30. Consider a general reaction



The rate expression for the reaction is $\text{Rate} =$

$k[A]^x[B]^y$. Write any two differences between

order and molecularity.



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31. 'Reaction with zero order is possible but zero molecularity is not'. Justify the statement.



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32. Unit of rate constant (k) of a reaction depends on the order of the reaction

Value of ' k ' of two reaction are given below.

Find the order of each reaction

$$k = 3 \times 10^{-2} \text{ mol L}^{-1} \text{ s}^{-1}$$



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33. Unit of rate constant (k) of a reaction depends on the order of the reaction

Value of ' k ' of two reactions are given below.

Find the order of each reaction

$$k = 5 \times 10^{-3} \text{ mol L}^{-1} \text{ s}^{-1}$$



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34. Write integrated rate equation for a first order reaction.



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35. Write the relation between half life $t_{\frac{1}{2}}$ and rate constant (k) of a first order reaction .



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36. Rate constant (k) of a reaction is $5 \times 10^{-2} \text{ s}^{-1}$. Find the half life $\left(t_{\frac{1}{2}}\right)$ of the reaction.



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



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38. The term order and molecularity are common in chemical kinetics. Write two factor influencing rate of a reaction



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



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40. Integrated rate expression for rate constant of first order reaction is given by

$$k = \frac{2.303}{t} \log \frac{[[R]]_0}{[R]} \text{ for general reaction}$$

$R \rightarrow P$. Derive an expression for half life period of first order reaction.



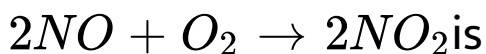
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41. A first order reaction has a rate constant $1.15 \times 10^{-3} \text{ s}^{-1}$. How long will 5 g of this reactant take to reduce to 3 g?



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42. The molecularity of reaction



A. 5

B. 2

C. 3

D. 0

Answer: C



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



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44. What will be the effect of temperature on a rate of a reaction?



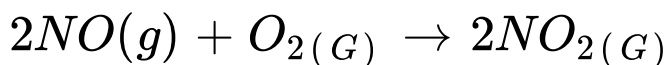
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45. A first order reaction is found to have a rate constant, $k = 5.5 \times 10^{-4} \text{ s}^{-1}$. Find out the half-life of the reaction.



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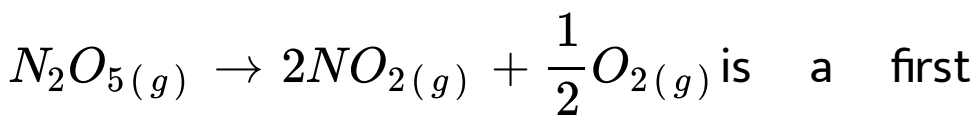
46. Rate of a reaction is the change in concentration of any one of the reactants or any one of the products in unit time. Express the rate of the following reaction in terms of reactants and products



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47. Rate of a reaction is the change in concentration of any one of the reactants or

any one of the products in unit time.



order reaction. Find the unit of k



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48. Rate of a reaction is the change in concentration of any one of the reactants or any one of the products in unit time. Calculate the time required for the completion of 90% of a first order reaction ($k = 0.2303s^{-1}$)



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



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50. What do you mean by zero order of a reaction?



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51. The initial concentration of the first order reaction, $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ was $1.24 \times 10^{-2} \text{ mol L}^{-1}$. The concentration of N_2O_5 after '1' hour was $0.20 \times 10^{-2} \text{ mol L}^{-1}$. Calculate the rate constant of the reaction at 300 K.



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



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53. The effect of temperature on rate of reaction is given by Arrhenius equation. Define activation energy(E_a)



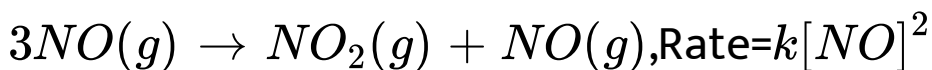
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54. Rate constant k_2 of a reaction at 310 K is two times of its rate constant k_1 at 300 K. Calculate activation energy of the reaction.
($\log 2=0.3010, \log 1=0$)



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55. For the reaction

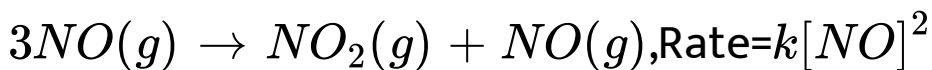


.What is the constant k in the above expression known as?



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56. For the reaction

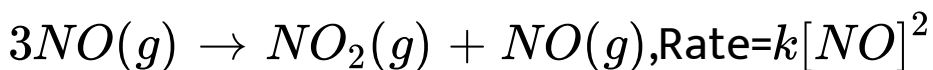


.What is the order of the reaction?



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57. For the reaction

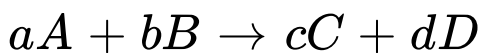


.Determine the dimension of k in the above reaction.



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58. Consider a general reaction



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



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





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60. A reaction is first order in A and second order in B. How is the rate affected when the concentration of B is doubled?



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61. 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?



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62. A quantitative relation between rate constant k and temperature was proposed by Arrhenius. Represent the Arrhenius equation and explain the terms involved



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63. A quantitative relation between rate constant k and temperature was proposed by Arrhenius. What is the nature of the plot

obtained if $\log k$ is plotted against $1/T$? what will be the slope of this plot equal to ?



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64. The rate constant of a reaction are $1 \times 10^{-3} \text{ s}^{-1}$ and $2 \times 10^{-3} \text{ s}^{-1}$ at 27° C and 37° C respectively. Calculate the activation energy of the reaction.



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65. The rate constant of a reaction at 298 K is given by $3.2 \times 10^{-3} s^{-1}$. Find the order of reaction?



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66. The decomposition of NH_3 on the surface of metal like platinum is a zero order reaction. Write the expression for the rate law of this reaction.



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67. The decomposition of NH_3 on the surface of metal like platinum is a zero order reaction. What is the unit of the rate constant k for this reaction?



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68. The decomposition of NH_3 on the surface of metal like platinum is a zero order reaction. What type of plot do you expect for rate

versus concentration for a zero order reaction?



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69. Zero order reaction means that the rate of a reaction is independent of the concentration of reactants. Write the integral rate expression for the zero order reaction, $R \rightarrow P$



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70. The decomposition of NH_3 on the surface of metal like platinum is a zero order reaction. Give another example of a zero order reaction.



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