

CHEMISTRY

BOOKS - V 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, $2A \rightarrow \text{product}$, the concentration of A decreases from 0.5molL^{-1} to 0.4molL^{-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. For the reaction $3NO(g) \rightarrow NO_2(g) + NO(g)$, $\text{Rate} = k[NO]^2$. Determine the dimension of k in the above reaction.

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11. For the reaction: $2A + B \rightarrow A_2 + B$, the rate $= k[A][B]^2$ with $k = 2.0 \times 10^{-6} \text{ mol}^{-2} \text{ L}^2 \text{ s}^{-1}$. Calculate the initial rate of the reaction when $[A] = 0.1 \text{ mol L}^{-1}$, $[B] = 0.2 \text{ mol L}^{-1}$. Calculate the rate of reaction after $[A]$ is reduced to 0.06 mol L^{-1} .

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12. 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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13. The decomposition of dimethyl ether leads to the formation of $(CH)_4$ and $(H)_2$ and (CO) and the reaction rate is given by Rate $= (k)[(CH)_3(OCH)_3]^{\frac{3}{2}}$ The rate of reaction is followed by increase in pressure in a closed vessel, so the rate can also be expressed in terms of the partial pressure of dimethyl ether, i.e., Rate $= (k)P(CH)_3(OCH)_3^{\frac{3}{2}}$ If the pressure is measured in bar and time in minutes, then what are the units of rate and rate constants?

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14. Mention the factors that affect the rate of a chemical reaction.

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15. 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

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

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17. In a pseudo first order hydrolysis of ester in water, the following results were obtained: i) Calculate the average rate of reaction between the time interval 30 to 60 seconds. ii) Calculate the pseudo first order rate constant for the hydrolysis of ester.

(##VPU_HSS_CHE_XII_C04_E02_008##)

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

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19. In a reaction between (A) and (B), the initial rate of reaction (r_o) was measured for different initial concentrations of A and B as given below: What is the order of the reaction with respect to (A) 'and (B) ?
(##VPU_HSS_CHE_XII_C04_E02_010##)

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20. The following results have been obtained during the kinetic studies of the reaction: $2A + B \rightarrow C + D$ Determine the rate law and the rate constant for the reaction. (##VPU_HSS_CHE_XII_C04_E02_011##)

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21. The reaction between A and B is first order with respect to A and zero order with respect to B. Fill in blanks in the following table: 1) A and B = 0.1, Initial rate = 2.0×10^{-2} , 2) B = 0.2 and initial rate = 4.0×10^{-2} , 3) A = 0.4 and B = 0.4, 4) B = 0.2 and initial rate = 2.0×10^{-2}

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

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23. The half-life for radioactive decay of ^{14}C is 5730 years. An archaeological artifact containing wood had only 80 % of the ^{14}C found in a living tree. Estimate the age of the sample.

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24. The Experiment data for decomposition of N_2O_5 $[2N_2O_5 \rightarrow 4NO + O_2]$ is gas phase at 318 K are given below:

i) Plot $[N_2O_5]$ against t. ii) Find the half-life period for the reaction.

iii) Draw a graph between $\log[N_2O_5]$ and t iv) What is the rate law Calculate the rate constant. vi) Calculate the half life period from K and compare it with(2) t/s=0,400,800,1200,1600,2000,2400,2800,3200 and $[N_2O_5]=1.63,1.36,1.14,0.93,0.78,0.64,0.53,0.43,0.35$ respectively

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25. 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 $\frac{1}{16}$ th value?

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26. During nuclear explosion, one of the products is $^{90}_{Sr}$ with half-life of 28.1 years. If $1 \mu\text{g}$ of $^{90}_{Sr}$ was absorbed in the bones of a newly born baby

instead of calcium, how much of it will remain after 10 years and 60 years if it is not lost metabolically.

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

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28. A first order reaction takes 40 min for 30 % decomposition. Calculate $t^{\frac{1}{2}}$

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29. For the decomposition of azoisopropane to hexane and nitrogen at 543K, the following data are obtained. Calculate the rate constant. $t=0,360S,720S$ and $P=35,54,63$ respectively.

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30. The following data were obtained during the first order thermal decomposition of $(SO)_2(Cl)_2$ at a constant volume, $(SO)_2(Cl)_2(g) \rightarrow (SO)_2(g) + (Cl)_2(g)$ Calculate the rate of the reaction when total pressure is 0.65 atm. $t=0, 100s$ and total pressure is 0.4, 0.7 respectively.

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31. The rate constant for the decomposition of $(N)_2(O)_5$ at various temperatures is given below: Draw a graph between $\log k$ and $\frac{1}{T}$ and calculate the values of (A) and E_a . Predict the rate constant at $30^\circ C$ and $50^\circ C$. (##VPU_HSS_CHE_XII_C04_E02_022##)

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32. The rate constant for the decomposition of hydrocarbons is $2.418 \times 10^{-5} (s)^{-1}$ at $546 (K)$. if the energy of activation is $179.9 \frac{kJ}{mol}$, what will be the value of pre-exponential factor:

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33. Consider a certain reaction $A \rightarrow Products$ with $k = 2.0 \times 10^{-2} (s)^{-1}$. Calculate the concentration of A remaining after 100s if the initial concentration of A is $1.0 molL^{-1}$

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34. Sucrose decomposes in acid solution into glucose and fructose according to the first order rate law, with $t_{\frac{1}{2}} = 3.00$ hours. What fraction of sample of sucrose remains after 8 hours?

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35. The decomposition of hydrocarbon follows the equation

$$k = (4.5 \times 10^{11} \text{ s}^{-1}) e^{-28000 \frac{K}{t}}$$

Calculate E_a



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36. The rate constant for the first order decomposition of $(H)_2(O)_2$ is given by the following equation: $\log k = 14.34 - 1.25 \times 10^4 \frac{K}{T}$ Calculate

E_a for this reaction and at what temperature will its half-period be 256 minutes?



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37. The decomposition of A into product has value of k as $4.5 \times 10^3 \text{ s}^{-1}$ at 10°C and energy of activation 60 kJ mol^{-1} . At what temperature would k be $1.5 \times 10^4 \text{ s}^{-1}$



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38. The time required for 10 % completion of a first order reaction at 298(K) is equal to that required for its 25 % completion at 308K. If the value of A is $4 \times 10^{10} (s)^{-1}$. Calculate (k) at 318(K) and (E_a).

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39. The rate of a reaction quadruples when the temperature changes from 293(~K) to 313(~K). Calculate the energy of activation of the reaction assuming that it does not change with temperature.

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40. The half-life for radioactive decay of ^{14}C is 5730 years. An archaeological artifact containing wood had only 80 % of the ^{14}C found in a living tree. Estimate the age of the sample.

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41. For the reaction $3NO(g) \rightarrow NO_2(g) + NO(g)$, $\text{Rate} = k[NO]^2$. What is the order of the reaction?

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42. Some statements related to kinetic are given below. The number of reactant molecules whose concentration changes can determine the rate.

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43. "A complex reaction consists of a number of steps. The overall rate of the reaction depends on the 'slowest step' Illustrate the above statement with an example and also mention the mechanism.

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44. "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 $R = 8.314 \text{ J K}^{-1} (\text{mol})^{-1}$

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45. Assuming that energy of activation for most of the reactions is 52 (kJ), what conclusion you draw about the effect of temperature on the rate of a reaction [Based on Arrhenius equation]

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46. Write the elementary steps of the reaction $2\text{O}_3 \leftrightarrow 3\text{O}_2$ and hence derive the rate law expression for this reaction. Comment as the order of the reaction.

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47. For the reaction. $2FeCl_3 + SnCl_2 \rightarrow 2FeCl_2 + SnCl_4$ What is the order and molecularity of the reaction?

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48. NH_3 decomposes as follows: $2NH_3 \rightarrow N_2 + 3H_2$
 $-d\frac{NH_3}{dt} = k_1[NH_3] + d\frac{N_2}{dt} = K_2[NH_3] + d\frac{H_2}{dt} = k_3[NH_3]$ derive the relationship between k_1 , k_2 and k_3

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49. What aspect of a reaction is influenced by presence of catalyst which increases the rate or possibility of the reaction?

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50. Give an example of a reaction having fractional order?

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51. Give an example of 1st order reaction?

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52. For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, how are the rate of reaction expressions $-d\frac{H_2}{dt}$ and $d\frac{NH_3}{dt}$ interrelated?

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53. Rate of reaction is given by $rate = k[A]^2[B]$ what are the units for the rate and the rate constant for this reaction?

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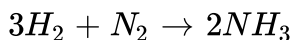
54. For the decomposition of N_2O_5 , rate law is $\text{rate} = (k)[N_2O_5]$ what is the significance of k in this equation?

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55. Write the expression, for half life of the reaction between hydrogen and chlorine to form hydrochloric acid gas?

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56. What is the rate of disappearance of hydrogen in the reaction ?



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57. Why a reaction does not proceed with a uniform rate throughout or why instantaneous rate is preferred over average rate?



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58. Why does boiling of an egg or cooking. of rice in an open vessel take more time at a hill station?



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59. In some cases, it is found that a large number of colliding molecules have energy more than threshold value, yet the reaction is slow. Why?



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60. What is the fraction of molecules having energy equal to or greater than activation energy E_a . What is this quantity called?



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61. Can a reaction have zero activation energy?

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62. On the basis of enthalpy of formation, graphite is more stable than diamond, yet diamond does not change into graphite for years. Explain why?

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63. Why coal does not burn itself in air but once initiated by flame, it continuous to burn?

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64. Can a reaction have negative activation energy?

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65. What is the value of rate constant at extremely high temperature ($T=\infty$) Is this rate constant feasible? Why?

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66. A 1st order reaction takes 69.3 minutes for 50 % completion. Derive an equation for determining the time needed for 80 % completion of this reaction.

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67. For a 1st order reaction, time taken for half of the reaction to complete is t_1 , whereas that for $3/4$ th of the reaction to complete is t_2 . How are t_1 and t_2 , related to each other?

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68. What is the effect of adding catalyst on the free energy change (ΔG) of a reaction?

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69. For the reaction $P \rightarrow Q$ rate of the reaction is expressed by $-d\frac{P}{dt}$ or $+d\frac{Q}{dt}$. What is the significance of plus and minus signs in this case?

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70. Consider the reaction. $(NO)_2 + (CO) \rightarrow (NO) + (CO)_2$ Answer the following questions. a) Write down the 2 steps through which the reaction takes place? b) Find out the slowest step? c) Which is the rate determining step? d) Find out the order of the reaction?

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71. Write the expression showing the change of concentration with time in the exponential form for reactions of 1 st order?

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72. The activation energy of a reaction is zero. Will the rate constant of the reaction depend upon temperature? Give reason.

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73. The specific reaction rate of a reaction is $6.2 \times 10^{-3} (\text{mol})(\text{L})^{-1}(\text{s})^{-1}$.

What is the order of the reaction?

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74. A substance with initial concentration 'a' follows zero order kinetics. In how much time will the reaction go to completion?

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75. The reaction $A + 2B \rightarrow C$ obeys the rate equation $\text{rate} = k[A]^{0.5}[B]^{1.5}$ what is the order of the reaction?

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76. A reaction is 50 % complete in 2 hours and 75 % complete in 4 hours .
What is the order of the reaction?

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77. a) The units of the rate constant K for two therefore different reactions are give: i) $(\text{mol})(L)^{-1}(S)^{-1}$ ii) $\left(\frac{\text{mol}}{L}\right)^{-1} (S)^{-1}$ Against each of these units write the re-spective order of the reaction:

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78. A relation connecting rate constant and temperature is called Arrhenius equation. a) Write the equation

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79. Consider the reaction. $(NO)_2 + (CO) \rightarrow (NO) + (CO)_2$ Answer the following questions. a) Write down the 2 steps through which the reaction takes place? b) Find out the slowest step? c) Which is the rate determining step? d) Find out the order of the reaction?

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

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81. Choose the correct answer. a) The equation for $t_{\frac{1}{2}}$ of first order reaction is i) $t_{\frac{1}{2}} = \frac{0.693}{K}$ ii) $t_{\frac{1}{2}} = \left[\frac{A_0}{2K} \right]$

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82. A given sample milk turns sour at room temperature ($20^\circ C$) in 64 hours. In a refrigerator at ($3^\circ C$), milk can be stored three times as long before it sours. Estimate (a) the activation energy for souring of milk (b) how long it take milk to sour at ($40^\circ C$)

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83. The energy of activation for a reaction is $100(kJ)mol^{-1}$. Presence of a catalyst lowers the energy of activation by 75 %. What will be the effect on the rate of reaction at ($20^\circ C$), other things being equal.

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84. Ethylene is produced $C_4H_8 \rightarrow 2C_2H_4$. The rate constant is $2.48 \times 10^{-4} \text{ (sec)}^{-1}$. In what time will the molar ratio of ethylene to cyclobutane in reaction mixture attain the value (a) 1 (b) 100.

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85. A gas phase decomposition of dimethyl ether follows the 1st order kinetics $CH_3OCH_3 \leftrightarrow CH_4(g) + H_2(g) + CO(g)$. The reaction is carried out in a constant volume container at $(500^\circ C)$ and has a half life period of 14.5 (min). Initially only dimethyl ether is present at a pressure of 0.4 atmosphere. What is the total pressure of the system after 12 (min)? Assume Ideal behaviour

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86. The rate of decomposition of ammonia is found to depend upon the concentration of NH_3 according to the equation

$-d\frac{NH_3}{dt} = K_1\frac{NH_3}{1+K_2[NH_3]}$ What is the order of the reaction when

i) concentration of NH_3 is very high ii) concentration of NH_3 is 'very'

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87. For a first order reaction, derive expression for the degree of dissociation of the reactant in the exponential form.

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88. NH_3 decomposes as follows: $2NH_3 \rightarrow N_2 + 3H_2$

$-d\frac{NH_3}{dt} = k_1[NH_3] + d\frac{N_2}{dt} = K_2[NH_3] + d\frac{H_2}{dt} = k_3[NH_3]$ derive

the relationship between k_1 , k_2 and k_3

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89. In the Arrhenius equation for a first order reaction, the value of A and

E_a are $4 \times 10^{13} \text{ sec}^{-1}$ and 98.6 kJ mol^{-1} respectively. At what

temperature will its half life be 10 minutes?

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90. Find the two third life $t_{\frac{2}{3}}$ of a 1st order reaction in which $k = 5.48 \cdot 10^{-14} \text{ sec}^{-1}$.

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91. In a reaction, a substance A undergoes decomposition which is catalysed in presence of a finely divided catalyst. If there are enough sites on the catalyst so that 20 molecules of A react per second. What is the rate of the reaction for a 1M solution?

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92. A 1st order reaction takes 69.3 minutes for 50 % completion. Derive an equation for determining the time needed for 80 % completion of this

reaction.

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93. A gas phase decomposition of dimethyl ether follows the 1st order kinetics $CH_3OCH_3 \leftrightarrow CH_4(g) + H_2(g) + CO(g)$. The reaction is carried out in a constant volume container at $(500^\circ C)$ and has a half life period of 14.5 (min). Initially only dimethyl ether is present at a pressure of 0.4 atmosphere. What is the total pressure of the system after 12 (min) ? Assume Ideal behaviour

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94. Write the expressions for rates of reactions in terms of concentration of reactants and products for the following reactions: i) $2(N_2O)_5 \leftrightarrow 2(N_2O)_4 + (O)_2$ ii) $2(NO)_2 + (F)_2 \leftrightarrow 2(NO)_2(F)$

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95. For the reaction, $2N_2O_5(g) \leftrightarrow 4NO_2(g) + O_2(g)$. If the concentration of NO_2 increases by $3.0 \times 10^{-3} molL^{-1}$ in six seconds then what is the rate of reaction?

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96. For the reaction, $2N_2O_5(g) \leftrightarrow 4NO_2(g) + O_2(g)$. If the concentration of NO_2 increases by $3.0 \times 10^{-3} molL^{-1}$ in six seconds then what is the rate of reaction?

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97. The rate of formation of nitric oxide (NO) in the following reaction is $3.6 \times 10^{-3} (molL)^{-1} (s)^{-1}$

$$4NH_3(g) + 5O_2(g) \leftrightarrow 4NO(g) + 6H_2O(g)$$

Find the rate of disappearance of oxygen.

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98. Identify the order of the reactions for which the rate constants are: iii)

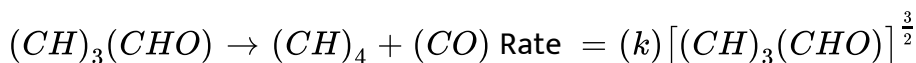
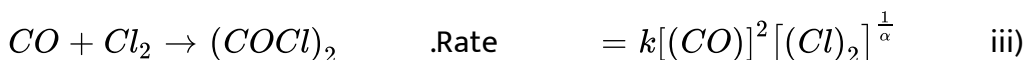
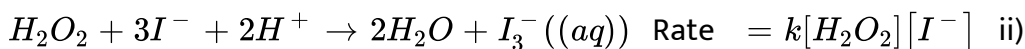
$$6.2 \times 10^{-2} (L)(mol)^{-1}(s)^{-1}$$

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99. For the reaction $(Cl)_2(g) + 2(NO)(g) \rightarrow 2(NOCl)(g)$ the rate law is expressed as $rate = (k)[(Cl)_2][(NO)]^2$ What is the overall order of this reaction.

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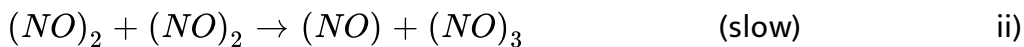
100. State the order with respect to each reactant, order of overall reaction and units of rate constant in each of the following reactions. i)



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101. For the reaction at 500(K) $NO_2(g) + CO(g) \rightarrow CO_2(g) + NO(g)$

the proposed mechanism is as follows: i)



$(NO)_3 + (CO) \rightarrow (CO)_2 + (NO)_2$ (fast) What is the rate law for the reaction?

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102. 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

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103. A first order reaction has rate constant of $10^{-2}(\text{sec})^{-1}$. Calculate the half life period for this reaction.

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104. The half life period of a reaction of first order is 100 sec. Calculate its rate constant.

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105. A first order reaction takes 5 minutes for the initial concentration of $0.6(\text{mol})(L)^{-1}$ to become $0.4(\text{mol})(L)^{-1}$. How long will it take for the initial concentration to become $0.3(\text{mol})(L)^{-1}$?

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106. A first order reaction is 75 % complete in 60 minutes: Find the half-life of this reaction.

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107. The reaction $\text{SO}_2\text{Cl}_2 \rightarrow \text{SO}_2 + \text{Cl}_2$, is a first order reaction with half life 3.15×10^4 at (320°C) What percentage of $\text{SO}_2 \text{Cl}_2$ would be

decomposed on heating at (320°C) for 90 minutes?

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108. The value of rate constant for the decomposition of nitrogen peroxide, $N_2O_5 \rightarrow N_2O_4 + \frac{1}{2}O_2$ is $3.46 \cdot 10^{-5}$ at 25 degree celcius and $4.87 \cdot 10^{-3}$ at 65 degree celcius. Calculate the énergy of activation for the reaction. $(R=8.314] (k)^{(-1)} (mol)^{(-1)}$

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109. In general it is observed that the rate of a chemical reaction doubles with every 10° rise in temperature. If this generalisation holds for a reaction in the temperature range $295(\sim K) \rightarrow 305(\sim K)$, what would be the value of activation energy for this reaction? $(R)=8.314 (Jk)^{(-1)} (\sim mol)^{(-1)}$

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110. In a reversible reaction both side rates of a reaction are : same, different, one side more, reactant rates less

A. same

B. different

C. one side more

D. reactant rates less

Answer: A



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111. The rate of a chemical reaction : increases as the reaction proceeds, decreases as the reaction proceeds, may increase or decrease during the reaction, remains constant as the reaction proceeds

A. increases as the reaction proceeds

B. decreases as the reaction proceeds

C. may increase or decrease during the reaction

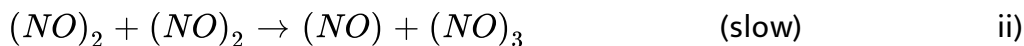
D. remains constant as the reaction proceeds

Answer: B

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112. For the reaction at 500(K) $NO_2(g) + CO(g) \rightarrow CO_2(g) + NO(g)$

the proposed mechanism is as follows: i)



$(NO)_3 + (CO) \rightarrow (CO)_2 + (NO)_2$ (fast) What is the rate law for the reaction?

A. $rate = -d\frac{NO_2}{dt}$

B. $rate = -d\frac{CO_2}{dt}$

C. $rate = d[NO_2] - d\frac{CO}{dt}$

D. $rate = d\frac{CO_2}{dt}$

Answer: A



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113. In a reaction $2A + B \rightarrow A_2B$ the reactant A will disappear at : half the rate at that B will decrease, the same rate at the B will decrease, the same rate at that A, B will form, twice the rate at that B will decrease

- A. half the rate at that B will decrease
- B. the same rate at the B will decrease
- C. the same rate at that A, B will form
- D. twice the rate at that B will decrease

Answer: D



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114. For a chemical reaction $(A) \rightarrow (B)$ it is found that the rate of the reaction quadruples when the concentration of (A) is doubled. The rate

expression for the reaction is rate = $(k)[(A)]^n$, where the value of (n)

is a)1 b)2 c)0 d)3

A. 1

B. 2

C. 0

D. 3

Answer: B



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115. In a reversible reaction $2NO_2 \leftrightarrow N_2O_4$ the rate of disappearance of

NO_2 is equal to : $\left(\left(\frac{(k)_1}{(k)_2} \right) [(NO)_2]^2 , 2K_1[NO_2]^2 - 2k_2[N_2O_4] \right)$

$2k_1[NO_2]^2 - k_2[N_2O_4] , (2K_1 - k_2)(NO_2)$

A. $(2(k)_1(k)_2[(NO)_2]_{right})^2$

B. $2K_1[NO_2]^2 - 2k_2[N_2O_4]$

C. $2k_1[NO_2]^2 - k_2[N_2O_4]$

D. $(2K_1 - k_2)(NO_2)$

Answer: B



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116. In which of the following cases, does the reaction go farthest completion (k)=10⁽²⁾ k=10⁽⁻²⁾ k=10 k=1

A. (k)=10⁽²⁾

B. k=10⁽⁻²⁾

C. k=10

D. k=1

Answer: A



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117. Decomposition of NH_3 on the surface of tungsten is a reaction of :
zero order, first order, second order, fractional order

- A. zero order
- B. first order
- C. second order
- D. tional order

Answer: A

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118. The rate of a gaseous reaction is given by the expression $k[C][D]$. If the volume of the reaction vessel is suddenly reduced to $\frac{1}{4}$ th of the initial volume, the reaction rate relating to original rate will be : 1/10, 1/8, 8, 16

- A. (1)(10)

B. (1)(8)

C. 8

D. 16

Answer: D



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119. The rate of the reaction is primarily determined by the slowest step.

This step is called rate determination step activation step reaction rate step none of these

A. rate determination step

B. activation step

C. reaction rate step

D. none of these

Answer: A



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120. The rate constant $k = Pz(e)^{\frac{-Ea}{RT}}$ which factor should show a decrease for the reaction to proceed more rapidly? T, Z, E, p

A. T

B. Z

C. E

D. p

Answer: C



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121. Which of the following statement true for molecularity of a reaction?

It is sum of exponents of the molar concentration of the reactants in the rate equation, It may have a fractional value, It is the number of

molecules of the reactants taking part in a single step chemical reaction,
It is determined experimentally

- A. It is sum of exponents of the molar concentration of the reactants
in the rate equation
- B. It may have a fractional value
- C. It is the number of molecules of the reactants taking part in a single
step chemical reaction
- D. It is determined experimentally

Answer: C



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122. A zero order reaction. $f(A) \rightarrow$ products has rate constant $10^{-2}(\text{mol})(L)^{-1}(s)^{-1}$ of a process started with 10 moles of A in a one litre vessel, how many moles of A would be left unreacted after 10 minutes

A. 10

B. 5

C. 6

D. 4

Answer: D



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123. The temperature coefficient of most of the reaction lies between 1 and 3 2 and 3 1 and 4 2 and 4

A. 1 and 3

B. 2 and 3

C. 1 and 4

D. 2 and 4

Answer: B

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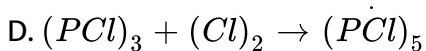
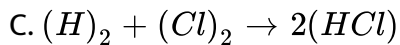
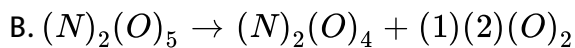
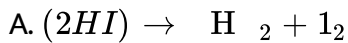
124. A zero order reaction is one whose rate is independent of temperature of the reaction concentration of the reactants concentration of the products the material of the vessel in which the reaction is carried out

- A. temperature of the reaction
- B. concentration of the reactants
- C. concentration of the products
- D. the material of the vessel in which the reaction is carried out

Answer: B

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125. A unimolecular reaction is : $2HI \rightarrow H_2 + I_2$,
 $N_2O_5 \rightarrow N_2O_4 + \frac{1}{2}O_2$, $H_2 + Cl_2 \rightarrow 2HCl$, $PCl_3 + Cl_2 \rightarrow PCl_5$



Answer: B

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126. The inversion of can sugar

$C_{12}H_{22}O_{11} + H_2O \rightarrow C_6H_{12}O_6 + C_6H_{12}O_6$. It is a reaction of : second order, pseudounimolecular, unimolecular, none of these

A. second order

B. pseudounimolecular

C. unimolecular

D. none of these

Answer: D

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127. The rate constant, activation energy and the Arrhenius parameter of a chemical reaction at $25^\circ (C)$ are $3 \times 10^{-4} (s)^{-1}$, $104.4 kJ(mol)^{-1}$ and $6 \times 10^{14} (s)^{-1}$ respectively. The value of the rate constant as $T \rightarrow \infty$ is

A. $2 \times 10^{18} (s)^{-1}$

B. $6 \times 10^{14} (s)^{-1}$

C. infinity

D. $3.6 \times 10^3 (s)^{-1}$

Answer: B

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128. Unit of rate constant for zero order reaction is

A. $\text{mol} (\text{L})^{-1} (\text{s})^{-1}$

B. $(\text{mol})^{-1} \cdot (\text{L})(\text{s})^{-1}$

C. $(\text{s})^{-1}$

D. $(\text{mol})^{-2} \text{L}^2 \text{s}^{-1}$

Answer: A

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129. For the reaction $(\text{N})_2 + (3\text{H})_2 \rightarrow 2(\text{NH})_3$, if $\frac{\text{NH}_3}{\delta} t = 2 \cdot 10^{-4} \text{ mol L}^{-1} \text{ s}^{-1}$ the value of $-\delta \frac{\text{H}_2}{\delta t}$

A. $1 \times 10^{-4} (\text{mol})(\text{L})^{-1} (\text{s})^4$

B. $3 \times 10^{-4} (\text{mol})^2 (\text{L})^{-1} (\text{s})^{-1}$

C. $4 \times 10^{-4} (\text{mol})(\text{L})^{-1} (\text{s})^{-1}$

D. $6 \times 10^{-1} (\text{mol})' (\text{L})^{-1} (\text{s})^{-1}$

Answer: B



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130. In the reaction $A + 2B \rightarrow C + 2D$ initial rate $-d\frac{A}{dt} = 2.6 \cdot 10^{-2} Ms^{-1}$ at $t=0$. What is the value of $-d\frac{B}{dt}$ at $t=0$ in Ms^{-1} ?

A. 2.6×10^{-2}

B. 5.2×10^{-2}

C. 1×10^{-1}

D. $+6.5 \times 10^{-3}$

Answer: B



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131. Diazonium salt decomposes as $C_6(H)_5(\sim N)_2^+(Cl) \rightarrow (C)_6(H)_5(Cl) + (N)_2$. At $0^\circ(C)$ the'

evolution of $(N)_2$ becomes two times faster when the initial concentration of the salt is doubled. Therefore it is

- A. a first order reaction
- B. second order reaction
- C. Independent of the initial concentration of the salt
- D. a zero order reaction

Answer: A



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132. For the reaction $(A) + (B) \rightarrow (C) + (D)$, doubling the concentration of both the reactants increases the reaction rate by 8 times and doubling the concentration of only B just doubles the reaction rate. The rate law is given as

A. $r = k \cdot [A]^{\frac{1}{2}} \cdot [B]^{\frac{t}{2}}$

B. $r = k[A][B]^2$

$$C. r = k[A]^2[B]$$

$$D. r = k[A][B]$$

Answer: C

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133. A first order reaction has specific reaction rate $2(\text{ min })^{-1}$. The half life of the reaction' will be

A. 1.653 min

B. 0.347 min

C. 2 min

D. 0.0347min

Answer: B

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134. The rate of reaction, is doubled for every 10° rise in temperature.

The increase in reaction rate as a result of temperature rise from 10° to 100° is

A. 112

B. 512

C. 400

D. 614

Answer: B



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135. In Arrhenius plot, the intercept is equal to

A. $(E_a)/R$

B. $\ln A$

C. $\ln k$

D. $\log_{10} a$

Answer: B



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136. A chemical reaction was carried out at 300K and 280K . The rate constants were found to be k_1 and k_2 respectively. Then

A. $k_2 = 4k_1$

B. $k_2 = 2k_1$

C. $k_2 = 0.25k_1$

D. $k_2 = 0.5k_1$

Answer: C



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137. The minimum energy required to permit a reaction is

- A. internal energy
- B. threshold energy
- C. activation energy
- D. free energy

Answer: B



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138. In a first order reaction $A \rightarrow (B)$ if (k) is rate constant and initial concentration of the reactant A is 0.5. M then the half life is

- A. $(\ln 2)(k)$
- B. $(0.693)(0.5)(k)$
- C. $(\operatorname{tog} 2)((k))$
- D. $(\log 2)(k)\sqrt{0.5}$

Answer: A

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139. Collision theory is applicable to

- A. first order reaction
- B. zero order reaction
- C. bimolecular reaction
- D. intramolecular reaction

Answer: C

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140. For a 1st order reaction, half life is 14 sec. The time required for the initial concentration to reduce to $\frac{1}{8}$ of its value is

A. $(14)^3(\text{sec})$

B. 28 sec

C. 42 sec

D. $(14)^2 \cdot \text{sec}$

Answer: C



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

A. linear with +ve slope and zero intercept

B. linear with -ve slope and zero intercept

C. linear with -ve slope and non zero intercept

D. a curve asymptotic to concentration axis

Answer: C

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142. The rate of reaction between two reactants A and (B) decreases by a factor of 4 if the concentration of reactant B is doubled. The order of this reaction with respect to the reactant B is

A. 2

B. -1

C. 1

D. -2

Answer: D

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143. Order of the photochemical reaction occurring between Hydrogen and Chlorine is

- A. zero order
- B. first order
- C. second order
- D. third order

Answer: A

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144. The reaction $(H)^+ + (O)(H)^- \rightarrow (H)_2(O)$ is

- A. very slow
- B. slow
- C. fast
- D. moderate in speed

Answer: C

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145. The time taken for 90% of 1st order reaction to complete is approximately

- A. 1.1 xx that of half life
- B. 2.2 xx that of half life
- C. 3.3 xx that of half life
- D. 4.4 xx that of half life

Answer: C



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146. The rate law for a reaction between the substances (A) and (B) is given by, rate = $k [A]^n [(-B)]^{(m)}$ On doubling the concentration of (A) and halving the concentration of B , the ratio of the new rate to the earlier rate of the reaction will be

A. $m+n$

B. $n-m$

C. $2^n - (m)$

D. $2^{1/m+n}$

Answer: C

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147. For a reaction $(1)(2)A \rightarrow 2(B)$, rate of disappearance of **A** is related to the rate of appearance of **B** by the expression

A. $-(d[A])(dt) = (d[B])(v \cdot dt)$

B. $-(d)[(A)](d)(dt) = 4(d)[(B)](dt)$

C.

D. $-(d)[(A)](dt) = (1)(4) (d)[(B)](dt)$

Answer: D

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148. If I is, the intensity of absorbed light and 'C' is the concentration of (AB) for the photochemical process $AB + h\nu \rightarrow AB^*$ the rate of formation of AB^* is directly proportional to : C, I, I^2, CI

A. C

B. I

C. I^2

D. I

Answer: B

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149. The reaction $A \rightarrow B$ follows first order kinetics. The time taken for 0.8 mole of A to produce 0.6 mole of B is 1 hour. What is the time taken for conversion of 0.9 mole of A to produce 0.675 mole of B.

A. 1 hour

B. 0.5 hour

C. 0.25 hour

D. 2 hours

Answer: A

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150. $3A \rightarrow 2B$ rate of reaction $d\frac{[B]}{dt}$ is equal to : $\frac{-3}{2}d\frac{[A]}{(dt)}$, $\frac{-2}{3}d\frac{[A]}{dt}$, $\frac{-1}{3}d\frac{[A]}{dt}$, $2d([A])(dt)$

A. $(-3)(2)(d)[(A)](dt)'$

B. $(-2)(3)(d)[(A)](\cdot dt)$

C. $(-1)(3)(d)[(A)](dt)$

D. $2(d)[(A)](d)(t)$

Answer: B



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151. DDT an exposure to water decomposes. Half life = 10 years. How much time will it take for its 99% decomposition? 50 years, 66.5 years, 500 years, 700 years

- A. 50 years
- B. 70 years
- C. 500 years
- D. 700 years

Answer: B



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152. Which of the following reactions ends in finite time? zero order, first order, second order, third order

- A. zero order
- B. first order
- C. second order
- D. third order

Answer: A

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153. The half lives of two samples are 0.1 and 0.4 second. Their respective concentration are 200 and 50 respectively. What is the order of the reaction?

- A. 0
- B. 2
- C. 1
- D. 4

Answer: B

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154. Activation energy is

- A. Threshold energy + average kinetic energy
- B. Threshold energy - average kinetic energy
- C. Threshold energy + potential energy
- D.

Answer: B

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155. The rate constants k_1 and k_2 for two different reactions are $10^{16} \times e^{-\frac{2000}{T}}$ and $10^{15} \times e^{-\frac{1000}{T}}$ respectively. The temperature at which $k_1 = k_2$ is : $1000k$, $\frac{2000}{2.303}k$, $2000k$, $\frac{1000}{2.303}k$

A. 1000k

B. (2000)(2.303) (k)

C. 2000k

D. (1000)(2.303) (k)

Answer: D

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156. The reaction $2(\text{FeCl})_3 + (\text{SnCl})'_2 \rightarrow 2(\text{FeCl})_2 + (\text{SnCl})_4$ is an example of

A. 1st order reaction

B. 2nd order reaction

C. 3rd order reaction

D. none of these

Answer: C

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157. The half life of a reaction is halved as the initial concentration of the reactant is doubled. The order of the reaction is

A. 0.5

B. 1

C. 2

D. 0

Answer: C

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158. Rate of a reaction can be expressed by Arrhenius equation, $k = Ae^{-E_a/RT}$. In this equation (E_a) represents (1) The total energy of the reacting molecules at a temperature. (2) The fraction of molecules with energy greater than the activation energy of the reaction. (3) The energy

above which all the colliding molecules will react. (4)The energy below which colliding molecules will not react.

- A. the total energy of the reacting molecules at a temperature
- B. the tion of molecules with energy greater than the activation energy of the reaction
- C. the energy above which all the colliding molecules will react
- D. the energy below which colliding molecules will not react

Answer: C

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159. $\frac{1}{[A]}$ vs time is a straight line. The order of the reaction is

- A. 1
- B. 2
- C. 3

D. 0

Answer: B

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160. For the reaction $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$, how are the rate of reaction expressions $-d\frac{H_2}{dt}$ and $d\frac{NH_3}{dt}$ interrelated?

A. $\frac{d}{dt}[(NH)_3] = - \frac{d}{dt}[(H)_2]$

B. $\frac{d}{dt}[(NH)_3] = -\frac{1}{3} \frac{d}{dt}[(H)_2]$

C. $\frac{d}{dt}[(NH)_3] = \frac{2}{3} \frac{d}{dt}[(H)_2]$

D. $\frac{d}{dt}[(NH)_3] = -\frac{3}{2} \frac{d}{dt}[(H)_2]$

Answer: C

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161. For a chemical reaction $xA \rightarrow yM$ the rate law is $r = k[A]^3$. If the concentration of (A) is 'doubled the reaction rate will be

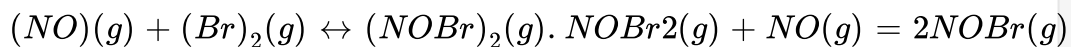
- A. doubled
- B. quadrupled
- C. increases by 8 times
- D. unchanged

Answer: C



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162. The following mechanism has been proposed for the reaction of (NO) with $(Br)_2$ to form $NOBr$.



If the 2nd step is the rate determining step, the order of the reaction with

$(NO)(g)$ is

A. 3

B. 2

C. 1

D. 0

Answer: B



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163. Which of the following process does not involve a catalyst?

A. Haber process

B. Thermite process

C. Ostwald process

D. Contact process

Answer: B



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164. A catalyst increases the rate of reaction because it : increases the activation energy, decreases the energy barrier for reaction, decreases the collision diameter, increases the temperature coefficient

- A. increases the activation energy
- B. decreases the energy barrier for reaction
- C. decreases the collision diameter
- D. increases the temperature coefficient

Answer: B



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165. A catalyst is used : only for increasing the velocity of the reaction, for altering the velocity of the reaction, only for decreasing the velocity of the reaction, all (a), (b) and (c) are correct

- A. only for increasing the velocity of the reaction
- B. for altering the velocity of the reaction
- C. only for decreasing the velocity of the reaction
- D. all (a), (b) and (c) are correct

Answer: B

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166. Which of the following statements regarding catalyst is not true? A catalyst remains unchanged in composition and quantity at the end of the reaction, A catalyst can initiate a reaction, A catalyst does not alter the equilibrium in a reversible reaction, Catalysts are sometimes very specific in respect of reaction

- A. A catalyst remains unchanged in composition and quantity at the end of the reaction
- B. A catalyst can initiate a reaction

C. A catalyst does not alter the equilibrium in a reversible reaction

D. Catalysts are some xx very specific in respect of reaction

Answer: B



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167. According to absorption theory of catalysis, the speed of the reaction increases because

A. The concentration of reactant molecules at the active centres of the catalyst becomes high due to absorption

B. in the process of absorption the activation energy of the molecules become large

C. absorption produces heat which increases the speed of the reaction

D. all of the above

Answer: A



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168. Enzymes are

- A. substances made by chemists to activate washing powder
- B. very active vegetable catalysts
- C. catalysts formed in organisms
- D. synthetic catalysts

Answer: C



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169. Enzymes are

- A. microorganisms

B. proteins

C. inorganic compounds

D. moulds

Answer: B



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170. The enzyme which catalyse the conversion of glucose to ethanol is

A. zymase

B. invertase

C. maltase

D. diastase

Answer: A



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171. Half change time for a 1st order reaction is 20 minutes, hence the rate constant for the reaction is

A. 0.346 (min)^{-1}

B. $0.0346 \text{ (min)}^{-1}$

C. 3.46 (min)^{-1}

D. 0.693 (min)^{-1}

Answer: B



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