CHEMISTRY

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR CHEMISTRY

CHEMICAL KINETICS

Example

1. The decompoistion of N_2O_5 in CCI_4 solution at $318K$ has been studied by monitoring the concentration of N_2O_5 in the solution. Initially, the concentration of N_2O is $2.33M$ and after $184\ \min$, it is reduced to $2.08M$. The reaction takes place according to the equation:

$2N_2O_5 \rightarrow 4NO_2 + O_2$

Calculate the average rate of this reaction in terms of hours, minutes, and seconds. What is the rate of Production of NO_2 during this period?

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2. $N_2 + 3H_2 \rightarrow 2NH_3$, the rate of disappearance of nitrogen is $0.02 mol L^{-1} s^{-1}$. What is the rate of apperance of ammonia?

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3. A_2B is an ideal gas, which decomposes according to the equation $A_2B \rightarrow A_2 + \frac{1}{2}B_2$. At start, the initial pressure is 100 mm of Hg and after 5 minutes, the pressure is 120 mm of Hg. What is the average rate of decomposition of A_2B? Assume T and V are constant.

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4. A chemical reaction $2A \rightarrow 4B + C$ in gas phase occurs in a closed vessel. The concentration of B is found to increase by 5×10^{-3} mol L^{-1} in 10 seconds. Calculate i) the rate of appearance of B ii) the rate of disappearance of A.

A. $5 \times 10^{-4} mol^{-1} L^{-1} \sec^{-1}$

B. $1.25 \times 10^{-4} mol^{-1} L^{-1} \sec^{-1}$

C. $2.5 \times 10^{-4} mol^{-1} L^{-1} \sec^{-1}$

D. $6.25 \times 10^{-4} mol^{-1} L^{-1} \sec^{-1}$

Answer:

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5. At 27° C and 37° C , the specific rates of a reaction are given as $1.62 \times 10^{-2} s^{-1}$ and $3.2 \times 10^{-2} s^{-1}$. Calculate the energy of activation for the given reaction.

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6. The temperature coefficient of a reaction is 2 and the rate of reaction at 25° C is $3 mol L^{-1} \min^{-1}$. Calculate the rate at $75^\circ C$

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7. For the reaction $NO_2 + CO \rightarrow CO_2 + NO$, the rate law is : Rate $= k[NO_2]^2$. Propose the probable mechanism of this reaction.

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8. $Mg_3N_2 + H_2O \rightarrow$

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9. 1) Nitrogen dioxide reacts with hydrogen to give nitrogen and water according to the equation:

$2NO_2 + H_2 \rightarrow N_2 + H_2O_2$ (slow)

$H_2 + H_2O_2 \rightarrow 2H_2O$ (fast)

What is the predicted rate law?

(1) Rate $= K[NO_2]$,

(2) Rate $= K[H_2]^2$

(3) Rate $= K[NO_2]^2[H_2]$

(4) Rate $= K[NO_2][H_2]$

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10. For the reaction $NO_2(g) + CO(g) \rightarrow NO(g) + CO_2(g)$, the experimentally determined rate expression at 40 K is:

rate $= k[NO_2]^2$

What is the proposed mechanism for the reaction?

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11. The reaction: $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$ was studied and the following data were collected

Determine (i) the order, (ii) the rate law and (iii) rate constant for the reaction.

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12. In a reaction between A and B, the initial rate of reaction was measured for different initial concentration of A and B as given below :

What is the order of reaction with respect to A and B?

A. 1,2

B. 2,1

C. $\frac{1}{2}, 0$

D. $\frac{1}{2}, 1$

Answer:

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13. The initial concentratin of N_2O_5 in the following first order reaction $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2O_2}(g) was 1.24 \times 10^{-2} molL^{-1}$ at 318K. The concentration of N_2O_5 after 60 minutes was $0.20 \times 10^{-2} molL^{-1}$. Calculate the rate constant of the reaction at 318 K.

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14. The following data were obtained during the first order thermal decomposition of N_2O_5 (g) at constant volume:

$2N_2O_5(g) \rightarrow 2N_2O_4(g) + O_2(g)$

$(\text{S.no, Time, Total Pressure / atm}), (1, 0, 0, 5), (2, 100, 0.512)$

Calculate the rate constant.

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15. Calculate the time taken to reduce $\frac{1}{16}$ th of the original amount if rate constant is given $60s^{-1}$

A. $4.62 \times 10^{-2}s$

B. $2.13 \times 10^{-2}s$

C. $8.5 \times 10^{-2}s$

D. 1.065×10^{-2}

Answer:

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16. Calculate the half life of the first order reaction from their rate constant given as $100s^{-1}$

(1) $100s^{-1}$

(2) $6.93 \times 10^{-2}s$

(3) $0.693 \times 10^{-3}s$

(4) 6.93×10^{-3}s

(ii) Calculate the half life of the first order reaction from their rate constant given as $0.5\ \text{min}^{-1}$

(1) 1.386 min, (2) 0.3465 min

(3) 0.231 min, (4) 1.0395 min

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17. A first order reaction is 20% complete in 10 minutes. Calculate the period during which 25% of the initial amount remain.

1) 35 min

2) 20 min

3) 62.15 min

4) 40 min

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18. Show that for a first order reaction, time required for $99.99\,\%$ of the reaction to take place is 10 times the time required for the completion of half of the reaction.

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19. A reaction $SO_2Cl_2 \rightarrow SO_2 + Cl_2$ is first order reaction with half life period 3.15×10^4s at 320°C. What percentage of SO_2Cl_2 would be decomposed on heating at 320°C for 90 minutes?

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20. 75% of a first order reaction is completed in 30min. Calculate (a) half life, (b) rate constant and (c) time required for 99.9% completion of the reaction

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21. A first order reaction is 20% complete in 10 min. How long it takes to complete 80% ?

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22. The initial concentration of ethyl acetate is $0.85 molL^{-1}$ - Following the acid catalysed hydrolysis, the conentration of ester after 30min and 60min o f the reaction are resp ectively 0.8 and $0.754 molL^{-1}$. Calculate the rate constant and pseudo rate constant.

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23. For a reaction $A + 2B \rightarrow$ products, when B is taken in excess, then the rate law expression and order is

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24. The following data were obtained during the first thermal decompoistion of $N_2O_5(g)$ at constant volume.

$2N_2O_5(g) \rightarrow 2N_2O_4(g) + O_2(g)$

S.No.	Time (s)	Total pressure (atm)
$i.$	0	0.5
$ii.$	100	0.512

Calculate the rate constant.

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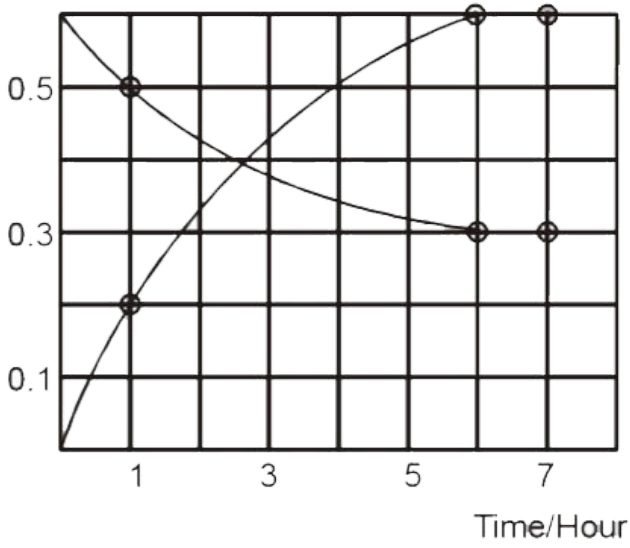
25. The progress of the reaction $A \Leftrightarrow nB$ with time, is presented in figure. Determine



the value of n.

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26. A first order reaction is $50\,\%$ complete in 30 minutes at 27°C and in 10 minutes at 47°C. Calculate the reaction rate constants at these temperatures and the energy of activation of the reaction in kJ/mol (R=8.314 $Jmol^{-1}K^{-1}$)

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27. At 380° the half-life period for thefirst order decomposition ofH_2O_2 is 360 min. The energy of activation of the reaction is 200 kJ mol^{-}. Calculation the time required for 75% decomposition at450° C

(1) 20.35 min,

(2) 40.7 min

(c) 120 min

(d) 60 min

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28. The rate constant for an isomerization reaction, $A \rightarrow B$ is $4.5 \times 10^{-3}\ \text{min}^{-1}$. If the initial concentration of A is $1M$, calculate the rate of the reaction after $1h$.

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Evaluate Yourself 1

1. For the reacton: $4A + B \rightarrow 2C + 2D$, The statements not correct is:

A. The rate of disappearance of B is one fourth the rate of disappearance of A

B. The rate of appearance of C is half the rate of disappearance of B

C. The rate of formation o f D is half the rate of consumption of A

D. The rate of disappearance of X = 1/2 rate of appearance of products

Answer: A

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2. Which of the following statement is correct for a reaction X + 2Y —> prodcuts

A. The rate of disappearance of X = twice the rate of disappearance of Y

B. The rate of disappearance of X = 1/2 rate of appearance of products

C. The rate of appearance of products =1/2 the rate of disappearance of Y

D. The rate of appearance of products =1/2 the rate of disappearance of X

Answer: B

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Evaluate Yourself 2

1. The rate law for the single-step reaction, $2A + B \rightarrow 2C$, is given by:

A. Rate $= K[A]^2[B]$

B. Rate $=K[A]^2[B]$

C. Rate $K[2A][B]$

D. Rate $= K[A]^2[B]^0$

Answer: B

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2. For the reaction $2NO_2 + F_2 \rightarrow 2NO_2F$, following mechanism has been provided:

$NO_2 + F_2 \xrightarrow{\text{slow}} NO_2F + F$

$NO_2 + F \xrightarrow{\text{fast}} NO_2F$

Thus rate expression of the above reaction can be writtens as:

A. $r = k[NO_2]^2[F_2]$

B. $R = K[NO_2][F_2]$

C. $r = k[NO_2]$

D. $r = k[F_2]$

Answer: B

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3. A following mechanism has been proposed for a reaction

$2A + B \rightarrow D \rightarrow E$

$A + B \rightarrow C + D$(slow)

$A + C \rightarrow E$ (fast)

The rate law expression for the reaction by RDS methd is:

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

B. $r = K[A][B]$

C. $r = K[A]^2$

D. $r = K[A][C]$

Answer: B

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Evaluate Yourself 3

1. For the reaction: $A + B \rightarrow$ product $\frac{dx}{dt} = k[A]^a[B]^b$ if $\frac{dx}{dt} = k$, then the order of the reaction is:

A. 4

B. 3

C. 1

D. 0

Answer: D

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2. Rate constant of a first order reaction is $0.0693 \ \text{m in}^{-1}$. If we start with $20 \ \text{mol L}^{-1}$ concentration in what time, it is reduced to $2.5 \ \text{mol L}^{-1}$?

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Evaluate Yourself 4

1. Time required to decompose half the substance for a n^{th} order reaction is inversely proportional to : (Given that a : initial concentration):

A. a^{n+1}

B. a^{n-1}

C. a^{n-2}

D. a^{n}

Answer: D

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2. Which of the following statement are correct?

A. The order of a reaction is the sum of the components of all the concentration terms in the rate equation

B. The order of a reaction with respect to one reactant is the ratio of the change of logarithm of the rate of the reaction to the change in the logarithm of the concentration of the particular reactant, keeping the co ncentration all oth er reactants constant

C. Orders of reactions can be whole numbers of fractional numbers

D. The order of a reaction can only be determined from the stoichiometric equation for the reaction.

Answer: D

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Evaluate Yourself 6

1. The rate of a chemical reaction generally increases rapidly even for small temperature increases because of a rapid increase in

A. Collision frequency

B. Fraction of molecules

C. Activation energy

D. Average kinetic energy of molecules

Answer:

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2. Arrhenius studies the effect of temperature on the rate of a reaction and postulted that rate constant varies with temperature exponentially as $k = Ae^{E_a/RT}$. Thuis method is generally used for finding the activation energy of a reaction. Keeping temperature constant, the effect of catalyst on the activation energy has also been studied.

The pre-exponetial factor in the Arrhenius equation of a first order reaction has the unit :

A. $molL^{-1}s^{-1}$

B. $Lmol^{-1}s^{-1}$

C. s^{-1}

D. dimensionless

Answer:

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3. The rates of most reactions double when their temperature is raised from 298 K to 308 K. Calculate their activation energy.

A. 52.89 kJ

B. 53 J

C. 106 kJ

D. 106 J

Answer:

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4. For a reaction, the activation energy is zero. What is the value of rate constant at $300K$ if $k = 1.6 \times 10^6 s^{-1}$ at 280 K $\left(R = 8.31 JK^{-1} mol^{-1}\right)$?

A. ∞

B. 0

C. 1.6×10^6s

D. $8.31 s^{-1}$

Answer:

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Check Your Grasp

1. What is the instantaneous rate of a reaction.

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2. Find the unit of rate of reaction

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3. For a hypothetical reaction $A + 2B \rightarrow 3C$ Identify x, y and z.

$$-\frac{1}{x}\frac{dA}{dt} = -\frac{1}{y}\frac{dB}{dt} = \frac{1}{z}\frac{dC}{dt}$$

A. 1,2,3

B. 0,2,1

C. 3,2,1

D. 1,1,2

Answer: A

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4. Write factor effecting rate constant.

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5. What is temperature coefficient (T.C.)?

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6. How catalyst affect rate of reaction, explain?

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7. Molecularity of a reaction is never zero. Explain?

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8. The difference rate law for the reaction

$H_2 + I_2 \rightarrow 2HI$ is

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9. Find overall order of reaction if rate law expression are as follows:-

(a) rate $= K[CO]^2[Cl_2]^{0.5}$

(ii) rate $= K[CH_3COOC_2H_5]^1[H_2O]^0$

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10. Find unit of rate constant for (a) Zero order and (b) First order reaction

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11. Plot the graph of t $t_{1/2}$ vs concentration for first order and zero order reaction.

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12. What is activation energy ?

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13. Draw Energy Diagram for exothermic reaction and Explain effect of catalyst.

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14. Write the equation for relationship of rate constant and temperature.

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Cuq Rate Of Reaction

1. Under a given set of experiemental condition, with increase in the concentration of the reactants, the reate of a chemical reaction

A. decreases

B. increases

C. remains constant

D. first decreases and increses

Answer: B

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2. In a chemical reaction, rate of a chemical reaction increases with temperature. The reason is due to

A. number of collisions between molecules increases

B. decreases in activation energy

C. increase in the number of the molecules with activation energy

D. kinetic energy of reactants increases

Answer: C

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3. Which of the following is a very fast reaction ?

A. reaction between $KMnO_4$ and oxalic acid

B. reaction between $KMnO_4$ and mohr's salt

C. hydrolysis of ethyl acetate

D. thermal decomposition of N_2O_3

Answer: B

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4. K represents the rate constant of a reaction when log K is p lotted again st 1/T (T=temperature) the graph obtained is a

A. curve

B. a straight line with a constant positive slope

C. a straight line with constant negative slope

D. a straight line with no slope

Answer: C

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5. The time taken for effusion of 64 mL of oxygen will be as the time taken for the effusion of which of the following gases under identical conditions ?

A. $NaOH + HCl \rightarrow NaCl + H_2O$

B. $NaOH + HCl \rightarrow NaCl + H_2O$

C. $H^+ + OH^- \rightarrow H_2O$

D. $2NO + O_2 \rightarrow 2NO_2$

Answer: D

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6. If the first order reaction involves gaseous reactants and gaseous products the units of its rate are

A. Atm

B. Atm-sec

C. $Atm.\ \sec^{-1}$

D. $Atm^2\ \sec^2$

Answer: C

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7. In the sequence of reaction

$A \xrightarrow{K_1} B \xrightarrow{K_2} C \xrightarrow{K_c} D, K_3 > K_2 > K_1$ then the rate determining step of the reaction is

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8. Draw the graph that the concentration 'R', of the reactant and 't' the reaction time for a zero Order reaction.

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9. In which of the following case does the reaction go farthest to completion?

A. $K = 10^2$

B. $K = 10^{-2}$

C. K = 10

D. K = 1

Answer: A

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10. $2H_2 + O_2 \rightarrow 2H_2O$

2 g H_2 and 1 O_2 react to form H_2O

A. $D > A > C > B$

B. $D < A < B < C$

C. $D > b > A > C$

D. $D > B = C > A$

Answer: C

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11. Chemical kinetics, a branch of physical chemistry, deals with :

A. structure of molecules

B. heat changes in a reaction

C. physical changes in a reaction

D. rate of reactions

Answer: D

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12. The rate of a reaction

A. increase with increase in temperature

B. decrease with increase in temperature

C. does not depend on temperature

D. does not depend on concentration

Answer: A

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13. The rate of chemical reaction

A. increase as the reaction proceeds

B. decrease 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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14. Which of these does not influence the rate of reaction?

A. Nature of reactants

B. Concentration of the reactants

C. Temperature

D. Molecular mass

Answer: D

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15. The rate at which a substance reacts, depends on its:

A. Active mass

B. molecular mass

C. atomic mass

D. equivalent mass

Answer: A

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16. The term dc/dt in a rate equation refers to

A. concentration of reactants

B. change in concentration of reactants or products with time

C. velocity of the reaction

D. concentration of products

Answer: B

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17. A : Rate of reaction depends upon the concentration of the reactants.

R : The order of reaction can be negative with respect to substance present in the reaction.

A. The number of bonds broken in the reactant molecules and the number of bonds formed in- product molecules changes

B. Some of the reactant are solids at the room temperature

C. Some of the reactants are coloured

D. Some of reactants are liquids at room temperature

Answer: A

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18. The relation between the rate of a simple reaction and the concentration 'c' of the reacting species is given as

A. $rate \propto c$

B. $rate \propto \frac{1}{c}$

C. $rate \propto \frac{1}{c^n}$

D. $rate \propto c^n$ (n = order of reaction)

Answer: D

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19. Dimensions of rate of reaction involves

A. concentration only

B. time only

C. both concentration and time

D. neither time nor concentration

Answer: C

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20. Which of the following about the rate constant K of a reaction wrong ?

A. it remains unchanged throughout the course of reaction

B. it provides a convenient measure of reaction rate

C. it is expressed in the same $unit(\sec)^1$ for all reactions

D. the more rapid the reaction, the larger is the value of K, the slower the reaction the smaller is its value

Answer: C

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21. The value of the rate constant of a reaction depends on

A. time

B. activation energy

C. Temperature

D. half-life value

Answer: C

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22. For an irreversible chemical reaction, the concentration of the products with time

A. increaes

B. decreases

C. does not change

D. some more data required

Answer: A

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23. A catalyst

A. Increases the heat of the reaction

B. Decreases the heat of the reaction

C. Does not alter the heat of the reaction

D. Increases the number of collisions

Answer: C

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24. For the reaction $2NO_2 \rightarrow 2NO + O_2$ which of the following is false?

A. The decrease in $[NO_2]$ and the increase in [NO] proceed at the same rate

B. The rate of formation of NO is twice the rate of formation of O_2

C. The average rates of increase in the concentration of NO and O_2 are expressed as $\frac{d[NO]}{dt}$ and $\frac{d[O_2]}{dt}$

D. $\frac{d[NO]}{dt} = \frac{2d[O_2]}{dt}$

Answer: C

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25. The rate constant is given by the equation $K = Ae^{-E_a/RT}$ which factor should register a decrease for the reaction to proceed more rapidly:

A. T

B. K

C. A

D. E_a

Answer: D

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26. Arrhenius equation may be written as

A. $\frac{d \ln K}{dT} = \frac{E_a}{R} T$

B. $\frac{d \ln K}{dT} = \frac{E_a}{(RT)^2}$

C. $\frac{d \ln K}{dT} = -\left(\frac{E_a}{R} T\right)$

D. $\frac{d \ln K}{dT} = -\left(\frac{E_a}{(RT)^2}\right)$

Answer: B

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27. In Arrhenius plot, intercept is equal to

A. $-\left(\frac{E_a}{R}\right)$

B. ln A

C. ln K

D. $\log_{10} a$

Answer: B

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28. For the reaction $R \rightarrow P$ when concentration of R is made double the rate of reaction becomes 2.828 times the order of reaction is

A. Zero

B. 1

C. $\frac{1}{2}$

D. 2

Answer: C

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29. In the reaction $A + B \Rightarrow \text{Products}$, if B is taken in excess, then it is an example of

A. Second order reaction

B. Zero order reaction

C. Fractional order reaction

D. First order reaction

Answer: D

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30. Give the units of the rate constant for second order reaction.

A. lit.sec

B. lit.mol.sec

C. $mol^{-1}.lit.\sec^{-1}$

D. mol.sec

Answer: C

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31. A chemical reaction $A + 2B \Rightarrow AB_2$ follows in two steps

$A + B \Rightarrow$ AB(slow)

$AB + B \Rightarrow AB_2$ (fast)

Then the order of the reaction is

A. 3

B. 2

C. 1

D. 0

Answer: B

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32. A graph between time (t) and the substance consumed at any time is found to be a straight line passing through the orginal This indicates that the reaction is of :

A. log x

B. $\frac{1}{a-x}$

C. $\frac{\log a}{a-x}$

D. $\frac{1}{(a-x)^2}$

Answer: C

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33. The reaction that obeys the expression $t_{\frac{1}{2}} = \frac{1}{Ka}$ the order of reaction

A. 0

B. 1

C. 2

D. 3

Answer: C

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34. The rate equation for the hydrolysis of an ester in presence of NaOH is, rate=K [ester] [NaOH]. If the concentration of NaOH is increased by 100 times than that of ester, the order of the reaction will be

A. 1

B. 2

C. 0

D. 3

Answer: A

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35. When moleucles of type A react with molecules of type B in one-step process to give AB_2, the rate law is

A. $\text{rate} = K[A]^1[B]^2$

B. $\text{rate} = K[A]^2[B]^1$

C. $\text{rate} = K[2A][B]$

D. $\text{rate} = K[A][B]$

Answer: A

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36. The rate expression for a chemical reaction $2NO_2F \rightarrow 2NO_2 + F_2$ is given by rate = $K \mid NO_2F]$ The rate determining step may be

A. $2NOF_2 \rightarrow 2NO_2 + F_2$

B. $NO_2F + F \rightarrow NO_2 + F_2$

C. $NO_2F \rightarrow NO_2 + F$

D. $NO_2 + F \rightarrow NO_2F$

Answer: C

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37. The unit of rate of reaction and rate of rate constant are same for a :

A. fraction-order reaction

B. first-second reaction

C. first-order reaction

D. second-order reaction

Answer: B

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38. If a reaction obeys the following equation $K = \frac{2.303}{t}\frac{\log a}{a-x}$ then the order reaction is

A. 0

B. 1

C. 2

D. 3

Answer: B

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39. Units for the rate constant of first order reaction is

A. $\sec^{-1}$

B. $mol.\ lit^{-1}$

C. $lit.\ mol^{-1}$

D. $mol^3 . lit^{-1} . \sec^{-1}$

Answer: A

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40. A zero order reaction is one whose rate is independent of

A. temperature of the reaction

B. the concentration of the reactants

C. the concentration of the products

D. activation energy

Answer: B

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41. The dimensions of rate constant of a second order reaction involves :

A. neither time nor concentration

B. only time

C. time and concentration

D. time square and concentrations

Answer: C

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42. The decomposition of H_2O_2 is represented as $H_2O_2 \rightarrow H_2O + O(\text{slow})(O) + (O) \rightarrow O_2(\text{fast})$ Then the order of the reaction is

A. 1

B. 2

C. 0

D. 3

Answer: A

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43. $\left(-d\frac{NH_3}{dt}\right)$ represents

A. Rate of formation of Ammonia

B. Rate of decomposition of Ammonia

C. Rate of consumption of N_2

D. Rate of comsumption of H_2

Answer: B

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44. Which of the following is not a first order reaction

A. Hydrolysis of an ester in acidic medium

B. Decomposition of N_2O_5

C. decomposition of calcium carbide

D. Oxidation of nitric oxide.

Answer: D

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45. The order of a reaction

A. can never be zero

B. can never be fraction

C. must be a whole number

D. can be an integer or a fraction or zero

Answer: D

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46. The order of a reaction can be predicted with the help of

A. molecularity of the reaction

B. activation energy of the reaction

C. rate equation of the reaction

D. reaction rate

Answer: C

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47. For the reaction $A \rightarrow B$, the rate law expression is rate $= k[A]$. Which of the following statements is incorrect ?

A. The reaction follows first order kinetic

B. The $t_{\frac{1}{2}}$ of reaction depends upon initial concentration of reactants

C. K is constant for the reaction at a constant temperature

D. The rate law provides a simple way of predicting the concentration of reactants and products at any time after the start o f the reaction

Answer: B

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48. The decomposition of N_2O into N_2 and O in the presence of gaseous argon follows second kinetics with

$k = \left(5.0 \times 10^{11}\ \text{L mol}^{-1} s^{-1}\right) e^{-29000K/T}$

The energy of activation is

A. explosive reaction

B. second order reactions

C. first order reactions

D. thermal reactions

Answer: B

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49. C_o =initial concentration of the reactant C_t = concentration of the reactant at time t, k=rate constant of the reaction. Then the equation applicable for a first order reaction is

A. $C_t = C_o e^{-kt}$

B. $C_t = C_o e^{kt}$

C. $C_o = C_t e^{-kt}$

D. $\left(\frac{C_0}{C_t}\right) = 1$

Answer: A

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50. In a first order reaction fraction of the total concentration of the reactant varies with time 't' is equal to

A. e^{+kt}

B. $10^{+0.434kt}$

C. $\frac{1}{2^{-n}}$

D. e^{-kt}

Answer: D

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51. For a first order reaction, if 'a' is the initial concentration of reactant, then the half life time is

A. independent of a

B. $\propto a$

C. $\propto a^2$

D. $\propto a^3$

Answer: A

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52. If the rate expression for a reaction is $\frac{dx}{dt} = k[A]^{1/2}[B]^{3/2}$, the overall order of the reaction is :

A. 2

B. $\frac{1}{2}$

C. $\frac{3}{2}$

D. 1

Answer: A

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53. Which of the following statements is false

A. a fast reaction has a large rate constant and short half-life

B. Half life depends on concentration of reactants for first order reaction.

C. For a first order reaction,the half-life is independent of concentration

D. The half-life of a reaction is, the time required for the reaction to go to half of the intial concentration of reactants

Answer: B

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54. The time for half change for a zero order reaction is.....

A. proportional to the initial concentration

B. proportional to the square root of the initial concentration

C. independent of initial concentration

D. inversely proportional to the initial cone.

Answer: A

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55. Rate equation for a second order is

A. $K = \frac{2.303}{t}\frac{\log a}{a-x}$

B. $K = \frac{1}{t}\frac{\log a}{a-x}$

C. $K = \frac{1}{t}\frac{\log a}{a(a-x)}$

D. $K = \frac{1}{t^2}\frac{\log a}{a-x}$

Answer: C

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56. The hydrolysis of ethyl acetate $CH_3COOC_2H_5 + H_2O \xrightarrow{H^+} CH_3COOH + C_2H_5OH$ is a reaction of

A. Pseudo first order

B. Second order

C. Third order

D. Zero order

Answer: A

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57. Radioactive decay follows which order kinetics?

A. zero

B. 1

C. 2

D. 3

Answer: B

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58. A reaction involiving two different reactants can never be:

A. Second order reaction

B. First order reaction

C. Unimolecular reaction

D. Bimolecular reaction

Answer: C

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59. What is the order of a reaction which has a rate expression rate = $K[A]^{3/2}[B]^{-1}$

A. 43864

B. 43862

C. zero

D. None

Answer: B

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60. The molecularity of a reaction will be

A. fractional

B. zero

C. positive whole number

D. negative

Answer: C

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61. Which of the following is wrong

A. order of the reaction is negative, positive or fractional

B. order of the reactions is always equal to the sum of stoichiometric co-efficients

C. the order of a reactions may be zero

D. half life is independent of the concentration of reactants in first order reaction

Answer: B

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62. Which statement is correct ?

A. Molecularity of a reaction is same as the order of reaction

B. In some cases order of reaction may be same as the molecularity of the reaction

C. Molecularity may be zero

D. Molecularity may be fractional

Answer: B

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63. Which of the following cannot be determined experimentally.

A. Order

B. Rate

C. Rate constant

D. Molecularity

Answer: D

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64. Which of the following statements regarding molecularity of the reaction is correct?

A. Molecularity relates to mechanism of reaction

B. It cannot be negative or fractional

C. Molecularity of a complex reaction has two (or) more steps and each individual step has its own molecularity

D. All are correct

Answer: D

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65. To increase the rate of a chemical reaction, catalyst

A. increase the activation energy

B. decrease activation energy

C. reacts with products

D. do not changes the activation energy

Answer: B

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66. The energy of activation of a reaction is dependent on

A. temperature

B. pressure

C. concentration

D. nature of reactants

Answer: D

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67. If the activation energy of both the forward and the backward reactions are equal, then change in internal energy is

A. zero

B. $+Ve$

C. $-Ve$

D. cannot be predicted

Answer: A

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68. For the exothermic reaction $A+B \Rightarrow C+D$. $\Delta(H)$ is the heat of reaction and Ea is the activation energy. The activation energy for the formation of A+B will be

A. E_a

B. $\Delta(H)$

C. $E_a + \Delta(H)$

D. $\Delta(H) - E_a$

Answer: C

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69. The rate constant (K_1) of one reaction is found to be double that of the rate constant of (K_2) another reaction. Then the relationship - ' between the corresponding activation energies of two reactions $(E_1 \text{and} E_2)$ can be represented.

A. $E_1 > E_2$

B. $E_1 < E_2$

C. $E_1 = E_2$

D. $E_1 = 4E_2$

Answer: B

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70. Collision theory is applicable to

A. Uniniolecular reactions

B. Bimolecular reactions

C. Trimolecular reactions

D. Tetra molecular reactions

Answer: B

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71. The rate constant is given by the equation $k = P.\ Ze^{-E_a/RT}$. Which factor should register a decrease for the reaction to proceed more rapidly?

A. T

B. Z

C. E_a

D. P

Answer: C

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72. The excess of energy required for the reactant molecules to undergo a reaction is

A. Potential energy

B. Kinetic energy

C. Thermal energy

D. activation energy

Answer: D

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73. Threshold energy (TE), internal energy of reactants (IE) and energy of activation (AE) vA are related as

A. AE = TE + IE

B. TE = AE + IE

C. IE = AE - TE

D. TE = AE = IE

Answer: B

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74. The energy to be possessed by the molecule participating in the reaction to give the products

A. activation energy

B. threshold energy

C. average energy

D. threshold energy + average energy

Answer: B

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75. For a given reaction which one is higher than the rest among the following

A. Average energy

B. threshold energy

C. activation energy

D. Normal energy

Answer: B

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76. The value of energy of activation for radio active decay is

A. high

B. low

C. zero

D. moderate

Answer: C

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77. In arrhenius equation, the fraction of effective collisions is given by

A. $K = Ae^{\frac{-Ea}{RT}}$

B. A

C. $e^{\frac{-Ea}{RT}}$

D. RT

Answer: C

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78. On increasing the temperature by $10^{\circ} C$,

A. number of collisions get doubled

B. value of rate constant does not change

C. energy of activation increases

D. pecific rate of the reaction gets doubled

Answer: D

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79. The threshold energy of a chemical reaction depends upon

A. rature of reacting species

B. temperature

C. concentration of species

D. number of collisions

Answer: A

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80. Activation energy is _____ to rate of reaction

A. directly proportional

B. inversely proportional

C. equal

D. not related

Answer: B

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81. The rate of a reaction can be increased in general by all the factors except

A. using a catalyst

B. ncreasing the temperature

C. increasing the activation energy

D. increasing the concentration of reactants

Answer: C

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82. The energy of activation of positive catalyzed reaction as compared to that of an uncatalyzed reaction is

A. more

B. less

C. same

D. may be more or less

Answer: B

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83. For producing the effective collisions, the colliding molecules must posses

A. a certain minimum amount of energy

B. energy equal to greater than threshold energy

C. proper geometry

D. threshold energy and proper orientation

Answer: D

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1. The rate of a gaseous reaction is given by the expression k [A] [B]. If the volume of the reaction vessel is suddenly reduced to $1/4th$ of the initial volume, the reaction rate relating to original rate will be

A. $\frac{1}{16}$

B. $\frac{1}{8}$

C. 8

D. 16

Answer: D

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2. The rate of reaction for $A \rightarrow \quad \text{products}$ is 10 mole, lit^{-1} . $\overset{-1}{\min}$ when $t_1 = 2 \text{ min}$. The rate of reaction when $t_2 = 12 \text{ min}$. in the same units is

A. > 10

B. < 10

C. 10

D. 12

Answer: B

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3. $C_{12}H_{22}O_{11} + \underset{\text{excess}}{H_2O} \rightarrow \underset{\text{glucose}}{C_6H_{12}O_6} + \underset{\text{fructose}}{C_6H_{12}O_6}$

Rate law is expressed as

A. $r = K[C_{12}H_{22}O_{11}][H_2O]$

B. $r = K[C_{12}H_{22}O_{11}]$

C. $r = K[H_2o]$

D. $r = K[C_{12}H_{22}O_{11}][H_2O]^{2-}$

Answer: B

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

A. $K_2 = 4K$

B. $K_2 = 2K$

C. $K_2 = 0.25K_1$

D. $K_2 = 0.5K_1$

Answer: C

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5. The differential rate law for the reaction

A. $\frac{-d[H_2]}{dt} = \frac{-d[I_2]}{dt} = \frac{-d[HI]}{dt}$

B. $\frac{d[H_2]}{dt} = \frac{d[I_2]}{dt} = \frac{d[HI]}{dt}$

C. $\frac{1}{2}\frac{d[H_2]}{dt} = \frac{d[I_2]}{dt} = \frac{-d[HI]}{dt}$

D. $-2\frac{d[H_2]}{dt} = -2\frac{d[I_2]}{dt} = \frac{d[HI]}{dt}$

Answer: D

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6. Observe the following reaction:

$A(g) + 3B(g) \rightarrow 2C(g)$

The rate of this reaction $\left\{\frac{-d[A]}{dt}\right\}$ is $3 \times 10^{-3} \text{mol litre}^{-1}\text{min}^{-1}$. What is the value of $\frac{-d[B]}{dt}$ in mol $\text{litre}^{-1}\text{min}^{-1}$?

A. 3×10^{-3}

B. 9×10^{-3}

C. 10^{-3}

D. 1.5×10^{-3}

Answer: B

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7. For which of the following reactions k_{310}/k_{300} would be maximum?

A. $A + B \rightarrow C, E_a = 50kJ$

B. $X + Y \rightarrow Z, E_a = 40kJ$

C. $P + Q \rightarrow R, E_a = 60kJ$

D. $E + F \rightarrow G, E_a = 100Kj$

Answer: D

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8. The slope in the activation energy curve is 5.42×10^3 . The value of the activation energy is approximately

A. $104Jmol^{-1}$

B. $104MJmol^{-1}$

C. $104KJmol^{-1}$

D. $104Jmol^{-1}K^{-1}$

Answer: A

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9. For the reaction $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$, the rate of reaction with respect to NH_3 is $2 \times 10^{-3} Ms^{-1}$. Then the rate of the reaction with respect to oxygen in Ms^{-1}

A. 2×10^{-3}

B. 1.5×10^{-3}

C. 2.5×10^{-3}

D. 3×10^{-3}

Answer: A

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10. The rate of formation of SO_3 in the reaction

$2SO_2 + O_2 \rightarrow 2SO_3$

is 100 g $\min^{-1}$ Hence rate of disappearance of O_2 is

A. $50g\ \min^{-1}$

B. $100g\ \min^{-1}$

C. $20g\ \min^{-1}$

D. $40g\ \min^{-1}$

Answer: C

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11. The rate of the reaction at $40^\circ C$ is 5 units, then the rate of same reaction at $80^\circ C$ is (nearly)

A. 10 units

B. 40 units

C. 20 units

D. 80 units

Answer: D

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12. For the reaction $N_2 + 3H_2 \rightarrow 2NH_3$, if $\frac{d[NH_3]}{dt}. = 4 \times 10^{-4}$ mol $L^{-1}s^{-1}$, the value of $\frac{-d[H_2]}{dt}$ would be

A. 0.02

B. 50

C. 0.06

D. 0.04

Answer: C

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13. Rate equation

the correct matching is

A. I - d, II - c, III -a, IV - b

B. I - c, II - d, III - b, IV - a

C. I - a, II - b, III - c, IV - d

D. I - b, II - a, III - d, IV - c

Answer: B

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14. Assertion (A) : Rate of reaction will be doubled, when temperature increased from 298 k to 308 k.

Reason (R): The activation energy of reaction decreases with increase in temperature.

A. Both (A) and (R) are true (R) is the correct explanation to (A)

B. Both (A) and (R) are true but (R) is not the correct explanation to (A)

C. (A)is true but (R) is false

D. Both (A) and (R) are false

Answer: C

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Exercise 1 C W Order Of Reaction

1. for a reaction $2A + 3B \rightarrow Products$, the rate law expression is given by rate = $K(A)^1(B)^2$. The order of the reaction with respect to A,B and over all order of reaction ar

A. 1,2,1

B. 3,2,1

C. 1,2,3

D. 2,1,3

Answer: C

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2. The rate of a certain reaction at different times is as follows

Time	0	10	20	30
Rate	3.2×10^{-2}	3.18×10^{-2}	3.22×10^{-2}	3.19×10^{-2}

The order of the reaction is

A. 1

B. zero

C. 2

D. 3

Answer: B

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3. Which one the following statement for order of reactions is not correct ?

A. Order can be determined experimentally

B. Order of reaction is equal to sum of the powers of concentration terms in differential rate law

C. It is not affected with stoichiom etric coefficient of the reactants

D. Order can not be fractional

Answer: D

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4. Which of the following relation is correct for a first order reaction? (K=rate constant, r=rate of reaction, c = cone, of reactant)

A. $K = r \times c^2$

B. $K = r \times c$

C. $K = \frac{c}{r}$

D. $K = \frac{r}{c}$

Answer: D

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5. Rate constant of a reaction (k) is $175 \text{litre}^2 \text{mol}^{-2} \sec^{-1}$. What is the order of reaction ?

A. first

B. second

C. third

D. zero

Answer: C

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6. If the rate of reaction $A \rightarrow B$ triples on increasing the concentration of A by 9 times, then the order of reaction is

A. 2

B. 1

C. $\frac{1}{2}$

D. 4

Answer: C

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7. The half life period for catalytic decomposition of AB_3 at 50 mm is found to be 4 hrs and at 100 mm it in 2 hrs. The order of reaction is :

A. 3

B. 1

C. 2

D. 0

Answer: B

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8. Reactant 'A' (initial concentration, a) reacts according to zero order kinetics, the time takews for the completion of the reaction is

A. $\frac{a}{K}$

B. $\frac{K}{a}$

C. $\frac{a}{2K}$

D. $\frac{2K}{a}$

Answer: A

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9. The conversion of $A \rightarrow B$ follows second-order kinetics. Doubling the concentration of A will increase the rate of formation of B by a factor

A. 4

B. 2

C. $\frac{1}{4}$

D. $\frac{1}{2}$

Answer: A

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10. The rate constant is numerically the same for three reaction of first , second and third order respectively. Which one is true for the of three reaction, if concentration of reactant is greater than 1M ?

A. $r_1 = r_2 = r_3$

B. $r_1 > r_2 > r_3$

C. $r_1 < r_2 < r_3$

D. All of these

Answer: C

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11. For the reaction $A \rightarrow$ Products, it is found that the rate of reaction increases by a factor of 6.25 when concentration of A increases by a factor of 2.5. Calculate the order of reaction with respect to A.

A. 2.5

B. 2

C. 1

D. 0.5

Answer: B

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12. The initial rates for gaseous reaction $A + 3B \rightarrow AB_3$ are given below

 order of the reaction

A. zero

B. three

C. one

D. two

Answer: D

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13. 3/4 th of first order reaction was completed in 32 min, 15/16 the part will be completed in

A. 24 min

B. 64 min

C. 16 min

D. 32 min

Answer: B

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

A. 2

B. 1

C. zero

D. 3

Answer: C

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Exercise 1 C W Molecularity

1. Molecularity of the following elementary reactions $2NO + O_2 \rightarrow 2NO_2$

A. 0.5

B. 1

C. 2

D. 3

Answer: D

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2. For which of the following reactions the molecularity and order of the reaction are respectively two and two

A. Ester hydrolysis in acid medium

B. Inversion of cane sugar in acid aqueous solution

C. Hydrolysis of ethyl acetate in caustic soda aqueous solution.

D. Decomposition hydrogen peroxide in acid solution

Answer: C

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3. Assertion (A): Molecularity of a reaction cannot be more than three Reason (R): Probability of simultaneous collision between more than three particles is very less.

A. Both (A) and (R) are true (R) is the correct explanation to (A)

B. Both (A) and (R) are true but (R) is not the correct explanation to (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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4. Assertion (A): The molecularity of a reaction is a whole number other than zero, but generally less than 3

The order of a reaction is always whole number

A. Both (A) and (R) are true (R) is the correct explanation to (A)

B. Both (A) and (R) are true but (R) is not the correct explanation to (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: C

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5. The molecularity of an elementary reaction

$X + 2Y \rightarrow$ Products is

A. 1

B. 2

C. 3

D. 0

Answer: C

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Exercise 1 C W Half Life

1. ..... reaction obeys the expresison $t_{1/2} = 1/ka$ in chemical kinetics.

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2. Half life of a zero order reaction is 250sec. $t_{75\%}, t_{100\%}$ of the reaction respectively in sec. are

A. 500, 375

B. 375, 500

C. 300, 575

D. 575, 300

Answer: C

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3. The half-life period of a first-order chemical reaction is 6.93 min. The time required for the completion of 99% of the chemical reaction will be $(\log 2 = 0.301)$

A. 23.03 minutes

B. 46.06 minutes

C. 460.6 miniutes

D. 230.3 minutes

Answer: B

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4. 75% of a first order reaction is completed in 32 minutes. 50% of the reaction would have been completed in

A. 24 mins

B. 16 mins

C. 18 mins

D. 23 mins

Answer: B

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5. The half life periods of four reactions labelled by A,B,C & D are 30sec,4.8 min,180sec and 16 min, respectively. The fastest reaction is

A. A

B. B

C. C

D. D

Answer: A

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6. Half-life periods for a reaction at initial concentrations of 0.1M and 0.01 are 5 and 50 minutes respectively. Then the order of reaction is

A. zero

B. 1

C. 2

D. 3

Answer: C

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7. 75% of a first order reaction was completed in 32 min. When was 50% of the reaction completed ?

A. 24 min

B. 16 min

C. 8 min

D. 4 min

Answer: B

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Exercise 1 C W Collision Theory

1. When the activation energies of the forward and backward reactions are equal, then :

A. It is an exothermic process

B. It is an endothermic process

C. It is reaction for which $\Delta H = 0$

D. It is a sublimation process

Answer: B

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2. For an exothermic chemical process ocuuring in two process occuring in two steps as follows

$(i) A + B \to X(\text{slow}) \qquad (ii) X \to AB(\text{fast})$

The progress of reaction can be best described by :

A. 

B. 

C. 

D. All correct

Answer: B

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3. The energy profile diagrams of two reactions are shown in the figure. Then

A. Reaction $A \to B$ is faster and more exothermic than reaction $C \to D$

B. Reaction $C \to D$ is faster than reaction $A \to B$ but less exothermic

C. Reaction $C \to D$ is faster and more exothermic than the reaction $A \to B$.

D. Reaction $C \rightarrow D2\frac{1}{2}$ times faster than reaction $A \rightarrow B$ at the same temperature

Answer: C

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4. For a reversible reaction , which one of the following statements is wrong from the given energy profile diagram:

A. Activation energy of forward reaction is greater than backward reaction

B. The forward reaction is endothermic

C. The threshold energy is less than that of activation energy

D. The energy of activation of forward reaction is equal to the sum of heat of reaction and the energy of activation of backward reaction.

Answer: C

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Exercise 1 H W Rate Of Reaction Factors

1. The increase in rate constant of a chemical reaction with increasing temperature is (are) due to the fact (s) that

A. 290 K - 300 K

B. 300 K - 310 K

C. 310 K - 320 K

D. 320 K - 330 K

Answer: A

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2. For $3A \rightarrow xB$, $\frac{d[B]}{dt}$, is found to be 2/3 rd of $\frac{d[A]}{dt}$, Then the value of 'x' is

A. 1.5

B. 3

C. 2

D. 5

Answer: D

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3. For a chemical reaction, $A \rightarrow$ products, the rate of reaction doubles when the concentration of 'A' is increased by a factor of 4, the order of reaction is :

A. Remain same

B. Becomes four times

C. Become 1.414 times

D. Becomes double

Answer: C

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4. Observe the following reaction

$2A + B \rightarrow C$

The rate of formation of C is $2.2 \times 10^{-3} \text{mol L}^{-1} \text{min}^{-1}$. What is the value of $-\frac{d[A]}{dt}$ $\left(\text{in mol L}^{-1} \text{min}^{-1}\right)$?

A. 2.2×10^{-3}

B. 1.1×10^{-3}

C. 4.4×10^{-3}

D. 5.5×10^{-3}

Answer: C

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5. Assertion (A) : The rate of reaction can also increase w.r.t its product if one of the products act as catalyst

Reason (R) : A catalyst lowers the activation energy of reactions.

A. Both (A) and (R) are true (R) is the correct explanation to (A)

B. Both (A) and (R) are true but (R) is not the correct explanation to (A)

C. (A) is true but (R) is false

D. Both (A) and (R) are false

Answer: A

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6. In the reaction $2NO_2 + O_2 \rightarrow 2NO_2$, if the rate of disappearance of O_2 is 16gm.min 1, then the rate of appearance of NO_2 is

A. $90gm.\ M \in^{-1}$

B. $46gm.\ \min^{-1}$

C. $28gm.\ \min^{-1}$

D. $32gm.\ \min^{-1}$

Answer: B

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7. $2A + B \rightarrow D + E$, for the reaction proposed mechanism $A + B \rightarrow C + D$ (slow), $A + C \rightarrow E$ (fast). The rate law expression for the reaction is

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

B. r=K[A][B]

C. $r = K[A]^2$

D. r=K[A][C]

Answer: B

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Exercise 1 H W Order Of Reaction

1. which of the following represents the expression for $3/4$th life of first order reaction?

A. $\frac{2.303}{K}\log 3/4$

B. $\frac{2.303}{K}\log 3$

C. $\frac{2.303}{K}\log 4$

D. $\frac{K}{2.303}\log 4$

Answer: C

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2. For a reaction $A + B \rightarrow$ products, when B is taken in excess, then the rate law expression can be written as

A. Rate $= K[A]^1[B]^0$

B. Rate $= K[A]^1[B]^2$

C. Rate =K[A][B]

D. Rate $= K[A]^2[B]^1$

Answer: A

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3. The unit of rate constant obeying the rate expression $r = k[A]^1[B]^{2/3}$ is :

A. $\text{mole}^{-2/3}\text{lit}^{2/3}\text{time}^{-1}$

B. $\text{mole}^{2/3}\text{lit}^{-2/3}\text{time}^{-1}$

C. $\text{mole}^{-2/3}\text{lit}^{2/3}\text{time}^{-1}$

D. $\text{mole}^{2/3}\text{lit}^{2/3}\text{time}^{-1}$

Answer: A

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4. For a reaction, $3A \rightarrow$ Products, it is found that the rate of reaction becomes nine times if concentration of A is increased three times, calculate order of reaction.

A. 1

B. 2

C. 3

D. 1.414

Answer: B

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5. The rate constant for a first order reaction is $60s^{-1}$. How much time will it take to reduce the initial concentration of the reactant to its $1/10^{th}$ value?

A. $3837\,\sec^{-1}$

B. $0.03837\,\sec^{-1}$

C. $0.0387\ \min^{-1}$

D. $0.3837\,\sec^{-1}$

Answer: B

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6. Units of rate constant of first and zero order reactions in terms of molarity M are respectively:

A. $s^{-1}Ms^{-1}$

B. s^{-1}, M

C. Ms^{-1}, s^{-1}

D. M, s^{-1}

Answer: A

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7. For a given reaction, the half-life period was found to be directly proportional to the initial concentration of the reactant. The order of reaction is

A. 0

B. 1

C. 2

D. 3

Answer: B

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8. A reaction that is of the first order with respect to reactant A has a rate constant 6min^{-1}. If we start with $[A] = 0.5\text{mol}1^{-1}$, when would $[A]$ reach the value $0.05mol1^{-1}$

A. 0.384 atm

B. 15 atm

C. 20 min

D. 3.84 min

Answer: A

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9. For the reaction $A + B \rightarrow$ products, it is found that order of A is 1 and order of B is 1/2. When concentrations of both A & B are increased four times the rate will increase by a factor

A. 6

B. 8

C. 4

D. 16

Answer: B

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10. Rate constant of two reactions are given below. Indentifying their order of reaction.

(i) $k = 6.3 \times 10^{-2} Lmol^{-1} s^{-1}$

(ii) $k = 2.8 \times 10^{-4} s^{-1}$

A. one

B. zero

C. two

D. fractional

Answer: B

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11. 

$CH_3COOH + C_2H_5OH$

d) third order. The correct matching is

A. I-a, II-b, III-c, IV-d

B. I-b, II-a, III-d, IV-c

C. I-d, II-c, III-b, IV-a

D. I-b, II-c, III-d, IV-a

Answer: D

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Exercise 1 H W Molecularity

1. For an elementary process

A. The order and the m olecularity are identical

B. The order is greater than the m olecularity

C. The order is lesser than the m olecularity

D. The order is always fractional

Answer: A

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2. $A + B \rightarrow$ products is an elementary reaction. When excess of A is taken in this reaction,then the molecularity and order are respectively

A. 2 and 2

B. 2 and 1

C. 1 and 2

D. 1 and 1

Answer: B

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3. A reaction involiving two different reactants can never be:

A. can never be a second order reaction

B. can never be a unim olecular reaction

C. can never be a unim olecular reaction

D. can never be a first order reaction

Answer: B

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Exercise 1 H W Half Life

1. The product of half life $T_{1/2}$ and the square of initial concentration of the reactant (a) is constant. Then the order of reaction is

A. 2

B. 3

C. 0

D. 1

Answer: B

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2. 50% of a reaction is completed in 16 minutes. What fraction of the reaction would occur in 32 minutes ? Given that reaction follow first order reaction.

A. $1/2$

B. $1/4$

C. $1/8$

D. $3/4$

Answer: D

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3. Out of300g substance [decomposes as per 1st order]. How much (nearly)will remain after 18 hr? $\left(t_{1/2} = 3hr\right)$

A. 4.6 gm

B. 5.6 gm

C. 9.2 gm

D. 6.4 gm

Answer: A

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4. 75% of a first order process is completed in 30 min .The tim e required for 93.75% A completion of same process(in hr)?

A. 1

B. 120

C. 2

D. 0.25

Answer: A

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5. The half life of a radio active material is one hour.What would be the time required for 99.9% completion

A. 5 hours

B. 10 hours

C. 2 hours

D. 20 hours

Answer: B

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

A. 1.250 M

B. 5.00 M

C. 0.125 M

D. 0.250 M

Answer: C

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Exercise 1 H W Collision Theory

1. Consider the energy profile, for the reaction $x + y \rightarrow R + S$ .Which of the following deduction about reaction is not correct?

A. The energy o f activation for the backward reaction is 80 K J

B. The forward reaction is Endotherm ic

C. ΔH for the forw ard reaction is 20 kJ

D. The energy o f activation for F.R is 60 kJ

Answer: A

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2. The following figure denotes the energy diagram for a reaction

Then the activation energy of the reverse reaction is

A. 2x

B. 2y

C. $x + y$

D. $y - x$

Answer: C

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3. The energies of activation for forward and reverse reaction for $A_2 + B_2 \Leftrightarrow 2AB$ are $180 kJ mol^{-1}$ and $200 kJ mol^{-1}$ respectively. The presence of catalyst lowers the activation energy of both (forward and reverse) reactions by $100 kJ mol^{-1}$. The enthalpy change of the reaction $(A_2 + B_2 \rightarrow 2AB)$ in the presence of catalyst will be (in $kJ mol^{-1}$):

A. 300

B. 120

C. 280

D. -20

Answer: D

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4. Effective collision s are those in w hich molecules must:

A. Have energy equal to or greater th an the threshold energy

B. Have proper orientation

C. Acquire the energy o f activation

D. All of these

Answer: D

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Exercise 2 C W Rate Of Reaction Factors

1. For the elem entary reaction $2A \rightarrow C$ the concentration of A after 30 minutes was found to be 0.01 mole/lit. If the rate constant of the reaction is 2.5×10^{-2} lit $\text{mole}^{-1}\,\text{sec}^{-1}$ the rate of the reaction at 30 minutes is

A. $2.5 \times 10^{-4}\text{mole}^{-1}\text{lit}^{-1}\,\text{sec}^{-1}$

B. $2.5 \times 10^{-6}\text{mole lit}^{-1}\text{sec}^{-1}$

C. $2.5 \times 10^{-2}\text{mole lit}^{-1}\text{sec}^{-1}$

D. $2.5 \times 10^{-8}\text{mole}^{-1}\text{lit}^{1}\text{sec}^{-1}$

Answer: B

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2. For $2NH_3 \xrightarrow{Av} N_2 + 3H_2$ rate w.r.t N_2 is $2 \times 10^{-3} M \text{ min}^{-1}$, then rate w.r.t N_2 after 20 min will be (in $M\text{min}^{-1}$)

A. 2×10^{-3}

B. $> 2 \times 10^{-3}$

C. 10^{-4}

D. $< 2 \times 10^{-3}$

Answer: A

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3. The specific rate of reaction is 1.5×10^{-4} lit $\text{mole}^{-1}. \text{sec}^{-1}$. If the reaction is connected with 0.2 mole/lit of of the reactant, the initial rate of the reaction in mole $\text{lit}^{-1} \text{sec}^{-1}$ is

A. 1.5×10^{-4}

B. 3×10^{-5}

C. 6×10^{-6}

D. 6×10^{-5}

Answer: C

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4. For the process $2A \rightarrow$ Products, rate of reaction w.r.t A at 10th second is $2 \times 10^{-2} Ms^{-1}$, then rates of same process at 5th and 15 th seconds (order $\neq 0$) respectively are (in M/s)

A. 10^{-1} & 10^{-2}

B. 2.7×10^{-2} & 1.6×10^{-2}

C. 1.6×10^{2} & 2.7×10^{-2}

D. 2×10^{-2} & 2×10^{-2}

Answer: B

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5. For a reaction, $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$ rate of reaction is:

A.

$$N_2O_5 - 500mm/\ \min\ , NO_2 - 400mm/\ \min\ , O_2 - 200mm/\ \min$$

B.

$$N_2O_5 - 1000mm/\ \min\ , NO_2 - 1000mm/\ \min\ , O_2 - 500mm/\ \mathrm{mi}$$

C.

$$N_2O_5 - 1000mm/\ \min\ , NO_2 - 2000mm/\ \min\ , O_2 - 4000mm/\ \mathrm{m}$$

D.

$$N_2O_5 - 400mm/\ \min\ , NO_2 - 400mm/\ \min\ , O_2 - 400mm/\ \min$$

Answer: D

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6. The rate of the reaction:

$CH_3COOC_2H_5 + NaOH \rightarrow Ch_3COONa + C_2H_5OH$ is given by the equation,

rate $= k[CH_3COOC_2H_5][NaOH]$

If concenration is expressed in mol/L the units of k are

A. $\frac{1}{3}$ rd

B. $\frac{1}{9}$ th

C. $\frac{1}{16}$ th

D. 16 times

Answer: C

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7. The concentration of reaction decreases from 0.2 M to 0.05 M in 5 minutes. The rate of reaction in mole. $\text{lit}^{-1}.\ \text{sec}^{-1}$ is

A. 8.3×10^{-4}

B. 0.05

C. 0.0005

D. 0.15

Answer: C

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8. $A \to B, k_A = 10^{15} e^{-2000/T}$

$C \to D, k_c = 10^{14} e^{-1000/T}$

Temperature at which $k_A = k_c$ is

A. 1000 K

B. 2000 K

C. $\frac{2000}{2.303}$K

D. $\frac{1000}{2.303}$ K

Answer: D

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9. From the following data for the decomposition ofN_2O_5 at 30° C , find out the rate constant(in min-1). Volume of O^2 after 10 min. of the reaction=90ml. Volume of O^2 after completion of the reaction=100ml

A. 2.303

B. 0.2303

C. 0.02303

D. 23.03

Answer: B

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10. If doubling the concentration of a reactant $'A'$ increases the rate 4 times and tripling the concentration of $'A'$ increases the rate 9 times, the rate is proportional to

A. concentration of A

B. square of concentration of A

C. under root of cone, of A

D. cube of concentration of A

Answer: B

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11. Consider a system containing NO_2 and SO_2 in which NO_2 is consumed in the following two parallel reactions.

$2NO_2 \xrightarrow{K_1} N_2O_4, NO_2 + SO_2 \xrightarrow{K_2} NO + SO_3$

The rate of disappearance of NO_2 will be equal to

A. $K_1[NO_2]^2 + K_2[NO_2]$

B. $K_1[NO_2]^2 + K_2[NO_2[SO_2]$

C. $2K_1[NO_2]^2$

D. $2K_1[NO_2]^2 + K_2[NO_2][SO_2]$

Answer: D

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12. Consider a reaction, $2A + B \rightarrow$ Products

When concentration of B alone was doubled, the half-life did not change. When the concentration of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is :

A. s^{-1}

B. lit.$\mathrm{mol}^{-1}s^{-1}$

C. Unitless

D. mol.$\mathrm{lit}^{-1}s^{-1}$

Answer: A

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13. For a reaction, the rate constant is expressed as $k = Ae^{-40000/T}$. The energy of the activation is

A. 40000 cal

B. 88000 cal

C. 80000 cal

D. 8000 cal

Answer: C

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14. The reaction

$CH_3COOC_2H_5 + NaOH \rightarrow CH_3COONa + C_2H_5OH$ is allowed to take place with initial concentration of 0.2 mole/lit of each reactant. If the reaction mixture is diluted with water so that the initial concentration of each reactant becomes 0.1 mole/lit. The rate of the reaction will be

A. 1/8 th of the original rate

B. 1/4th of the original rate

C. 1/2 th of the original rate

D. same as the original rate

Answer: B

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15. For the decomposition reaction:

$N_2O_{4(g)} \rightarrow 2NO_{2(g)}$, the initial pressure of N_2O_4 falls from 0.46 atm to 0.28 atm in 30 minute. What is the rate of appearance of NO_2?

A. $12 \times 10^2 \text{atm. min}^{-1}$

B. $1.2 \times 10^2 \text{atm. min}^{-1}$

C. $1.2 \times 10^{-2} \text{atm. min}^{-1}$

D. $1.8 \times 10^{-1} \text{atm. min}^{-1}$

Answer: C

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16. The rate for the decomposition of NH_3 on platinum surface is zero order. What are the rate of production of N_2 and H_2 if $K = 2.5 \times 10^{-4} mollitre^{-1} s^{-1}$?

A. $3.75 \times 10^{-4}, 1.25 \times 10^{-4}$

B. $1.25 \times 10^{-4}, 3.75 \times 10^{-4}$

C. $1.25 \times 10^{-4}, 3.75 \times 10^{4}$

D. $1.25 \times 10^{4}, 3.75 \times 10^{-4}$

Answer: B

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17. $1\ \mathrm{dm}^3$ of $2MCH_3COOH$ is mixed with $1\ \mathrm{dm}^3$ of 3 M ethanol to form ester. The decrease in the initial rate if each solution is diluted with an equal volume of water would be

A. 2 times

B. 4 times

C. 0.25 times

D. 0.5 times

Answer: C

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18. For a reaction, $K = 2 \times 10^{13} e^{-30000/RT}$. When log K(y-axis) is plotted against 1/T (x-axis), slope of line will be..... Cal

A. $\frac{3000}{4.6}$

B. $-\frac{3000}{46}$

C. $-\frac{30000}{2.303}$

D. $-\frac{30000}{4.6}$

Answer: D

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19. The rate temperature changes from 300K to 310K. Activation energy of such a reaction will be $\left(R = 8.314JK^{-1}mol^{-1} \text{ and } \log 2 = 0.3010\right)$

A. $48.6kJmol^{-1}$

B. $58.5kJmol^{-1}$

C. $60.5kJmol^{-1}$

D. $53.6kJmol^{-1}$

Answer: D

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20. Give the following data for the reaction:

$X + Y \rightarrow Z$

Which one is the rate law equation?

A. Rate = K[X][Y]

B. Rate = $K[X]^0[Y]^1$

C. Rate $= K[X][Y]^0$

D. Rate $= K[X][Y]^2$

Answer: C

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21. The activation energy of a reaction is $9.0kcal/mol.$

The increase in the rate consatnt when its temperature is increased from $298K$ to $308K$ is

A. 0.1

B. 1

C. 0.5

D. 0.63

Answer: D

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22. At 300 K rate constant for $A \rightarrow$ product at t= 50 min in 0.02^{-1}, then rate constant at t= 75 min and 310 K will be in s^{-1}

A. $\frac{0.04}{25}$

B. 0.04×25

C. 0.04

D. $\frac{0.02}{25}$

Answer: C

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23. The rate expression for the reaction A(g) + B(g) $\rightarrow$ C(g) is rate = $KC_A^2 C_B^{½}$. What changes in the initial concentration of A and B will cause

the rate of reaction increase by a factor of eight?

A. $C_A \times 2, C_B \times 2$

B. $C_A \times 2, C_B \times 4$

C. $C_A \times 1, C_B = 4$

D. $C_A \times 4, C_B \times 1$

Answer: B

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24. For the reaction system $2NO(g) + O_2(g) \rightarrow 2NO(g)$ volume is suddenly produced to half its value by increasing the pressure on it. If the reaction is of first order with respect to O_2 and second order with respect to NO. The rate of reaction will

A. diminish to one - eight of its initial value

B. increase to eight times of its initial value

C. increase to four- times of its initial value

D. diminish to one fourth of its initial value

Answer: B

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25. The rate constant of a first order reaction at $27^\circ C$ is 10–3 min–1. The temperature coefficient of this reaction is 2. What is the rate constant (in min–1) at $17^\circ C$ for this reaction :-

A. 10^{-3}

B. 5×10^{-4}

C. 2×10^{-3}

D. 10^{-2}

Answer: B

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26. A reaction was found to be second order with respect to the concentration of carbon monoxide. If the concentration of carbon monoxide is doubled, with everything else kept the same, the rate of reaction will:

A. remain unchnged

B. tripled

C. increased by a factor four

D. doubled

Answer: C

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27. In the presence of acid, the initial concentration of cane sugar was reduced from 0.2 M to 0.1 M in 5 h and to 0.05 M in 10 h. The reaction must be of

A. 0.693

B. 1.386

C. 0.1386

D. 3.465

Answer: C

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28. If rate constant is numerically the same for three reaction of first, second and third order respectively, then which of the following is correct?

A. if $[A] = 1$, then $r_1 = r_2 = r_3$

B. if $[A] < 1$ then $r_1 > r_2 > r_3$

C. if $[A] > 1$ then $r_1 > r_2 > r_3$

D. All of these

Answer: D

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29. A first order reaction is 50% complete in 20 minutes. What is its rate constant?

A. 2.303 and0.3010

B. 2 and 0.3465

C. 2 and 0.693

D. 0.3010 and 0.693

Answer: B

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30. For a first order reaction , $A \rightarrow$ Products, the concentrations of A changes from 0.1 M to 0.025 M in 40 minutes. The rate of reaction when the concentration of A is 0.01 M is:

A. $3.47 \times 10^{-4} M \min^{-1}$

B. $3.47 \times 10^{-5} M \min^{-1}$

C. $1.73 \times 10^{-4} M \ \min^{-1}$

D. $1.73 \times 10^{-5} M \ \min^{-1}$

Answer: A

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31. For the reaction A $\rightarrow$ B that is first-order in A, The rate constant is $2.08 \times 10^{-2} s^{-1}$. How long would it take for [A] to change from $0.100 M$ to $0.0450 M$?

A. 60 s

B. 76 s

C. 50 s

D. 44 s

Answer: C

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Exercise 2 C W Order Of Reaction

1. The decomposition of CH_3OH occurs as $CH_3CHO(g) \rightarrow CH_4(g) + CO(g)$, the kinetic data provided is

The rate expression thus can be given as

A. $K[CH_3.CHO]$

B. $K[CH_3.CHO]^2$

C. $K[CH_3.CHO]^3$

D. $K[CH_3.CHO]^{1/2}$

Answer: B

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2. Calculate the order of reaction form the following data:

$2NH_3 \rightarrow N_2 + 3H_2$ (reaction)

Pressure (mm Hg)	50	100	200
Half lives (min)	3.52	1.82	0.93

A. min^{-1}

B. $atm.\ \text{Min}^{-1}$

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

D. $atm^{-2}.\ \text{min}^{-1}$

Answer: B

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3. For a first order reaction, $t_{0.75}$ is 1386 seconds, then the specific rate constant in $\sec^{-1}$ is

A. 10^{-3}

B. 10^{-2}

C. 10^{-9}

D. 10^{-5}

Answer: A

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4. For the reaction,

$N_2O_5 \rightarrow 2NO_2 + O_2, Given$

$$-\frac{d[N_2O_5]}{dt} = K_1[NO_2O_5]$$

$$\frac{d[NO_2]}{dt} = K_2[N_2O_5] \text{ and } \frac{d[O_2]}{dt} = K_3[N_2O_5]$$

The relation in between K_1, K_2 and K_3 is:

A. $K_1 = 2K_2 = 3K_3$

B. $2K_1 = 4K_2 = K_3$

C. $2K_1 = K_2 = 4K_3$

D. $K_1 = K_2 = K_3$

Answer: C

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5. For a given reaction of first order, it takes 20 minutes for the concentration to drop from $1.0 \text{mol liter}^{-1}$ to $0.6 \text{mol litre}^{-1}$. The time required for the concentration to drop from $0.6 \text{mol litre}^{-1}$ to $0.36 \text{mol litre}^{-1}$ will be

A. more than 20 min

B. less than 20 min

C. equal to 20 min

D. infinity

Answer: C

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6. At particular concentration , the half life of the reaction is 100 minutes. When the concentration of the reactant become double half life becomes , 25 minutes , then what will be the order of the reaction ?

A. zero

B. 0.5

C. 2

D. 1

Answer: C

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7. The rate constant of a reaction at temperature 200 K is 10 times less than the rate constant at 400 K. What is the activation energy (E_a) of the reaction ? (R = gas constant)

A. 1842.4 R

B. 921.2 R

C. 460.6 R

D. 230.3 R

Answer: B

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8. The chemical reaction $2O_3 \rightarrow 3O_2$ proceeds as follows :

$O_3 \rightarrow O_2O$ (fast)

$O + O_3 \rightarrow 2O_2$ (slow)

The rate law expression should be :

A. Rate $= K[O_3]^2$

B. Rate $= K[O_3]^2[O_2]^{-1}$

C. Rate $= K[O_3][O_2]$

D. Rate $= K[O_3][O_2]^{-1}$

Answer: B

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9. $75\ \%$ of a first-order reaction was completed in 32 minutes, when was $50\ \%$ of the reaction completed ?

A. 3

B. 1

C. 2

D. 0

Answer: C

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10. For a non-equilibrium process $A + B \rightarrow$ Produts the rate is first order with respect to A and second order with respect to B. If 1.0 Mole

each of A and B are introduced into a one liter vessel and the intial rate is 1.0×10^{-2}mol $L^{-1}s^{-1}$, the rate when half of the reaction have been eonsumed is:

A. $1 \times 10^{-2}\text{mol. lit}^{-1}. s^{-1}$

B. $2.5 \times 10^{-3}\text{mol. lit}^{-1}. s^{-1}$

C. $5.0 \times 10^{-2}\text{mol. lit}^{-1}. s^{-1}$

D. $0.5 \times 10^{-2}\text{mol. lit}^{-1}s^{-1}$

Answer: B

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11. A reaction $SO_2Cl_2 \rightarrow SO_2 + Cl_2$ is first order reaction with half life period 3.15×10^4s at 320°C. What percentage of SO_2Cl_2 would be decomposed on heating at 320°C for 90 minutes?

A. 1.118

B. 0.1118

C. 18.11

D. 11.18

Answer: D

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12. For reaction $aA \rightarrow xP$, when $[A] = 2.2mM$, the rate was found to be $2.4mMs^{-1}$. On reducing concentration of A to half, the rate changes to $0.6mMs^{-1}$. The order of reaction with respect to A is

A. 1.5

B. 2

C. 2.5

D. 3

Answer: B

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13. The rates of a reaction at different times are given below

The order of the reaction is

A. 2nd order

B. zero order

C. 3rd order

D. 1st order

Answer: B

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14. The isomerization of cyclopropane to form propane is a first order reaction. At $760K$, $85\ \%$ of a sample of cyclopropane change to propane in $79\ \min$. Calculate the value of the rate constant.

A. $2.42\ \min^{-1}$

B. $3.66 \times 10^{-2}\ \mathrm{min}^{-1}$

C. $2.40 \times 10^{-3}\ \mathrm{min}^{-1}$

D. $1.04 \times 10^{-2}\ \mathrm{min}^{-1}$

Answer: C

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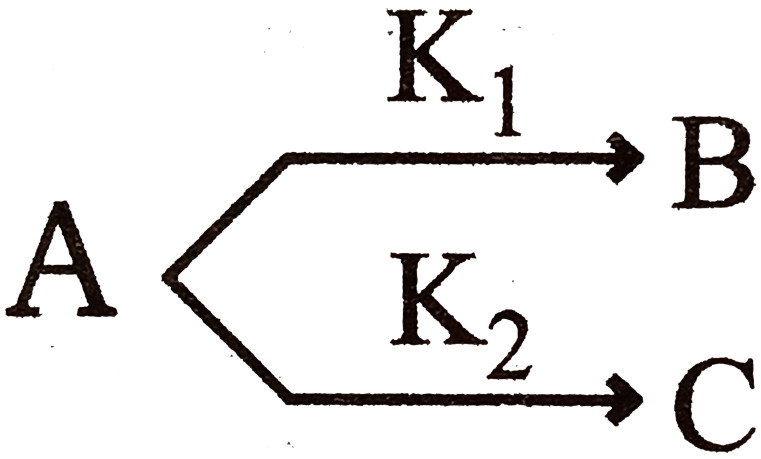
15. For a first order reaction,



which of the following relation is not correct?

A. The time taken for the completion of 75% of the reaction is twice $t_{1/2}$.

B. A plot of the reciprocal of the concentration of the reactants against time gives a straight line

C. The degree of dissociation is equal to $1 - e^{-kt}$

D. A plot of $[A]_0 / [A]$ versus time given a straight line.

Answer: A

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16. $t_{1/4}$ can be taken as the time taken for concentration of reactant to drop to $.^3/_4$ of its initial value. If the rate constant for a first order reaction is K, then $t_{1/4}$ can be written as:

A. 0.75 /K

B. 0.69 /K

C. 0.29 / K

D. 0.10 / K

Answer: C

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Exercise 2 C W Half Life

1. The half life period of a first order reaction is 10 minutes . The time required for the concentration of the reactant to change from 0.08 M to 0.02is :

A. 1500 sec

B. 900 sec

C. 500 sec

D. 600 sec

Answer: C

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2. Show that for any first order reaction, the time required for the completion of 99.9% of the reaction is 10times the half-life of the reaction.

A. 25 min

B. 12.5 min

C. 20 min

D. 10 min

Answer: B

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3. In 69.3 min, a first order reaction is 50% incom plete. How much reactants are left after 161 min?

A. 0.8

B. 0.4

C. 0.2

D. 60^

Answer: C

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4. 

nth order.

A. I-a, II-b, III-c, IV-d

B. I-b, II-c, III-d, IV-a

C. I-c, II-d, III-b, IV-a

D. I-d, II-c, III-b, IV-a

Answer: B

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Exercise 2 C W Collision Theory

1. For $A + B \rightarrow C + D, \Delta H = -20kJ\text{mole}^{-1}$. The activation energy for the forward reaction is 85 kJ. Then the activation energy for the backward reaction is ___

A. 65 kJ

B. 105 kJ

C. 85 kJ

D. 40 kJ

Answer: B

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2. An endothermic reaction, $A \rightarrow B$ have an activation energy $15kcal/mol$ and the heat of the reaction is $5kcal/mol$. The activation

energy of the reaction, $B \rightarrow A$ is:

A. 20

B. 15

C. 10

D. 5

Answer: C

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Exercise 2 H W Rate Of Reaction Factors

1. For a reaction, $E_a = 0$ and $k = 3.2 \times 10^4 s^{-1}$ at $300K$. The value of k at $310K$ would be

A. $6.4 \times 10^4 s^{-1}$

B. $3.2 \times 10^4 s^{-1}$

C. $3.2 \times 10^{8} s^{-1}$

D. $3.2 \times 10^{5} s^{-1}$

Answer: B

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2. The rate constant k, for the reaction $N_2O_5(g) \rightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$ is $2.3 \times 10^{-2} s^{-1}$. Which equation given below describes the change of $[N_2O_5]$ with time ? $[N_2O_5]_0$ and $[N_2O_5]_t$ correspond to concentration of N_2O_5 initially and at time, t ?

A. $[N_2O_5]_t = [N_2O_5]_0 + kt$

B. $[N_2O_5]_0 = [N_2O_5]_1 . e^{kt}$

C. $\log_{10}[N_2O_5]_t = \log_{10}[N_2O_5]_0 - kt$

D. $\frac{\ln([N_2O_5]_0)}{[N_2O_5]_t} = kt$

Answer: D

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3. The rate equation for the reactions $2A + B \rightarrow C$ is found to be: rate = $k[A][B]$. The correct statement in relation to this reaction is that the

A. unit o f K m ust be s^{-1}

B. value of K is independent of the initial concentration of A and B

C. rate of formation of C is twice the rate of disappearance of A.

D. $t_{1/2}$ is a constant.

Answer: B

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4. 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 as:

A. $\frac{1}{2^{m+n}}$

B. (m+n)

C. (n-m)

D. 2^{n-m}

Answer: D

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5. The hydrogenation of vegetable ghee at $25^{\circ}C$ reduces the pressure of H_2 form $2atm$ to $1.2atm$ in $50\ \min$. Calculate the rate of reaction in terms of change of

(a) Pressure per minute

(b) Molarity per second

A. 1.09×10^{-6}

B. 1.09×10^{-5}

C. 1.09×10^{-7}

D. 1.09×10^{-8}

Answer: B

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6. For a reaction $2SO_2 + O_2 \rightarrow 2SO_3$ rate of consumption of SO_2 is 6.4×10^{-3} kg/sec. the rate of formation of SO_3 in same units will be

A. 6.4×10^{-3}

B. 8×10^{-3}

C. 4×10^{-3}

D. 16×10^{-3}

Answer: B

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7. A gaseous $A_2(g) \rightarrow B(g) + \frac{1}{2}C(g)$, shows increase in pressure from 100 mm to 120 mm in 5 min. The rate of disappearance of A_2 is

A. $4mm,\ \min^{-1}$

B. $40mm,\ \min^{-1}$

C. $8mm,\ \min^{-1}$

D. $20mm\ \min^{-1}$

Answer: C

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8. Concentration of a reactant 'A' is changed from 0.044M to 0.032M in 25 minutes, the average rate of the reaction during this interval is

A. $0.0048\text{mol. lit}^{-1}.\ \text{min}^{-1}$

B. $0.00048mol.\ lit^{-1}\ \text{sec}^{-1}$

C. $4.8 \times 10^{-4} mol.\ lit^{-1}.\ \min^{-1}$

D. $0.0048 mol.\ lit^{-1} \sec^{-1}$

Answer: C

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9. For the reaction, $2A + B \rightarrow A_2B$, the reaction rate = $k[A][B]^2$ with k = $2.0 \times 10^{-6} mol^{-2} L^2 s^{-1}$. Calculate the initial rate of the reaction when [A] = 0.1 mol L^{-1}, [B]= 0.2 molL^{-1}. Also calculate the reaction rate when [a] is reduced to 0.06 mol L^{-1}.

A. [A] - 0.3 M, [B]- 0.2 M, [C]-0.2 M

B. [A]-0.2 M, [B]-0.1 M, [C]- 0.2 M

C. [A]-0.1 M, [B]-0.1 M, [C]0.1 M

D. [A] -0.2 M, [B]-0.2 M, [C]-0.1 M

Answer: C

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10. $xA + yB \rightarrow zC$. If $-\frac{d[A]}{dt} = -\frac{d[B]}{dt} = 1.5\frac{d[C]}{dt}$, then x, y and z are :

A. 1,1,1

B. 3,2,3

C. 3,3,2

D. 2,2,3

Answer: C

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11. For the reaction,

$Ag^+ + 2\ \mathrm{NH_3} \Leftrightarrow \left[\mathrm{Ag}(NH_3)_2\right]^+$,

the net rate of reaction is given by

$\frac{dx}{dt} = 2 \times 10^7 \left[\mathrm{Ag}^+\right][NH_3]^2 - 1 \times 10^{-2}\left[\mathrm{Ag}(NH_3)_2\right]^+$

Then which of the following statement/s is/are correct ?

A. $2 \times 10^{7} L^{2} mol^{-2}$

B. $2 \times 10^{9} L^{2} mol^{-2}$

C. $1 \times 10^{-2} L^{2} mol^{-1}$

D. $0.5 \times 10^{-9} L^{2} mol^{-2}$

Answer: B

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12. The following reaction is first order in A and first order of B:

$A + B \rightarrow \text{Product}, \text{Rate} = k[A][B]$

Relative rate of this reaction in vessel I and II of equal volume is:

A. $1:1$

B. $1:2$

C. $2:1$

D. $1:4$

Answer: B

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13. For the reaction $A \rightarrow$ Products, $\frac{-d[A]}{dt} = k$ and at different time interval, [A] values are

At 20 minutes, rate will be

A. 12 mol/min

B. 10 mol/min

C. 8 mol/min

D. 0.4 mol/min

Answer: D

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14. For the decomposition of dinitrogen pentoxide at $200^{\circ}C$,

$N_2O_5(g) \rightarrow N_2O_4(g) + \frac{1}{2}O_2(g)$,

if the intial pressure is 14 mm and after 25 minutes of the reaction, total pressure of the gassous mixture is 133 mm, calculate the average rate of reaction in (a) atm $\min^{-1}$ (b) mol $L^{-1}s^{-1}$.

A. $0.002, 8.58 \times 10^{-7}$

B. $0.001, 8.58 \times 10^{-7}$

C. $0.002, 8.58 \times 10^{-4}$

D. $0.0001, 8.58 \times 10^{-3}$

Answer: A

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15. Assertion : For a first order reaction,$t_{1/2}$ is indepent of rate constant.

Reason : For a first reaction $t_{1/2} \propto [R]_0$.

A. $4:1$

B. $2, 1$

C. $1:1$

D. $1:4$

Answer: D

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16. A substance $''A''$ decomposes in solution following the first order kinetics. Flask I contains $1L$ of $1M$ solution of A and falsk II contains $100mL$ of $0.6M$ solution. After $8hr$, the concentration, of A in flask I becomes $0.25M$. What will be the time for concentration of A in flask II to become $0.3M$?

A. 0.4 h

B. 2.4 h

C. 4.0 h

D. Can't be calculated since rate constant is not given

Answer: C

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17. The energy of activation for a reaction is 50kJ/ mol. Presence of a catalyst lowers the energy of activation by 25%. What will be the effect on rate of reaction at 30° C- Other things remains same.

A. 142.75

B. 242.75

C. 342.75

D. 442.75

Answer: A

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18. For the reaction 2A + 3B $\rightarrow$ product, A is in excess and on changing the concentration of B from 0.1 M to 0.4 M, rate becomes doubled. Thus, rate law is :

A. $\frac{dx}{dt} = k[A]^2[B]^3$

B. $\frac{dx}{dt} = k[A][B]$

C. $\frac{dx}{dt} = k[A]^0[B]^2$

D. $\frac{dx}{dt} = k[B]^{1/2}$

Answer: D

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19. A reaction is catalysed by H^+ ion. In presence of HA, rate constant is 2×10^{-3} $\min^{-1}$ and in presence of HB rate constant is 1×10^{-3} $\min^{-1}$. HA and HB being strong acids, we may conclude that

A. 0.5

B. 0.002

C. 0.001

D. 2

Answer: D

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Exercise 2 H W Order Of Reaction

1. Rate expression for $Xa + Yb \rightarrow$ products is Rate $= K[A]^m[B]^n$. Units of K w.r.t A and B respectively are s^{-1} and $M^{-1}s^{-1}$, when concentrations of A and B are increased by 4 times, then

A. $R_f = 16R_1$

B. $R_1 = 16R_f$

C. $R_f = 8R_1$

D. $R_f = 64R_i$

Answer: D

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2. A first order reaction was commenced with 0.2 M solution of the reactants. If the molarity of the solution falls to 0.02M after 100 minutes the rate constant of the reaction is

A. $2 \times 10^{-2} \text{ min}^{-1}$

B. $2.3 \times 10^{-2} \text{ min}^{-1}$

C. $4.6 \times 10^{-2} \text{ min}^{-1}$

D. $2.3 \times 10^{-1} \text{ min}^{-1}$

Answer: B

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3. The experiment data for the reaction

$2NO(g) + Cl_2(g) \rightarrow 2NOCl(g)$ are given below

What is the order of the reaction?

A. 1

B. 2

C. 3

D. 0

Answer: C

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4. The reaction $2A + B \rightarrow$ product follow the mechanism :-

$2A \Leftrightarrow A_2(\text{fast})$

$A_2 + B \rightarrow P(slow)$

`The order of the reaction is

A. 2

B. 1

C. 3

D. $1\left(\frac{1}{2}\right)$

Answer: C

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5. Diazonium salt decomposes as $C_6H_5N_2^+Cl^- \rightarrow C_6H_5Cl + N_2$. 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. a second order reaction

C. independent of the initial concentration of the salt.

D. a zero order reaction.

Answer: A

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6. Using the data given below the order and rate constant for the reaction:

$CH_3CHO(g) \rightarrow CH_4(g) + CO(g)$ would be

A. 2, $[K = 2.0l / \text{mol} / \text{sec}]$

B. 0, [K=2.0 mol /sec]

C. 2, [K=1.5 l/ mol/sec]

D. 1, $\left[K = 1.5 \sec^{-1}\right]$

Answer: A

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7. Calculate the activation energy of a reaction whose reaction rate at $300K$ double for $10K$ rise in temperature.

A. 40 K cal/mole

B. 10 K cal/mole

C. 20 Kcal/mole

D. $2^{\left(-\frac{20}{RT}K\,.\,\text{cal}/\,\text{mole}\right)}$

Answer: C

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8. The rate constant of a first order reaction is 0.0051min^{-1}. If the initial concentration of the reactant is 0.2M , find the concentration of the reactant after 2h.

A. 0.2303

B. 2.303

C. 0.693

D. 0.01

Answer: A

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9.

Half-life is independent on concentration of A. After 10 minutes volume of N_2 gas is 10 L and after completion of reaction 50 L. Hence, rate constant is :

A. $\frac{2.303}{10}\log 5 \text{ min}^{-1}$

B. $\frac{2.303}{10}\log 1.25 \text{ min}^{-1}$

C. $\frac{2.303}{10}\log 2 \text{ min}^{-1}$

D. $\frac{2.303}{10}\log 4 \text{ min}^{-1}$

Answer: B

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10. The time for half-life period of a certain reaction, $A \rightarrow$ products is $1h$. When the initial concentration of the reactant $'A'$ is $2.0 \text{mol} L^{-1}$, how much time does it take for its concentration to come from 0.50 to $0.25 \text{mol} L^{-1}$, if it is zero order reaction ?

A. 1

B. 2

C. 3

D. 0

Answer: B

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11. The equilibrium

$SO_2Cl_2(g) \Leftrightarrow SO_2(g) + Cl_2(g)$

is attained at $25^{\circ}C$ in a closed container and inert gas helium is introduced. Which of the following statement /s is / are correct ?

A. $1.505 \times 10^{-2} s^{-1}$

B. $1.202 \times 10^{-3} \text{ min}^{-1}$

C. $1.505 \times 10^{-2} \text{ min}^{-1}$

D. 0.3465 min^{-1}

Answer: C

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12. For a reaction $\frac{dx}{dt} = K\left[H^{+}\right]^{n}$. If pH of reaction medium changes from two to one rate becomes 100 times of value at $pH = 2$, The order of reaction is

A. 1

B. 2

C. 0

D. 3

Answer: B

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13. For the reaction of I, II and III orders, $k_1 = k_2 = k_3$ when concentrations are expressed in mole L^{-1}. What will be the relation in k_1, k_2, k_3, if the concentration are expressed in $molmL^{-1}$?

A. $K_1 = K_2 = K_3$

B. $K_1 = K_2 \times 10^{-3} = K_3 \times 10^{-6}$

C. $K_1 = 2K_2 = K_3$

D. $2K_1 = 3K_2 = 4K_3$

Answer: B

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14. 50 " mL of " pure and dry O_2 was subjected to silent electric discharge and on cooling to the original temperature, the volume of ozonised oxygen was found to be 47 mL The gas was brought into contact with turpentine oil, after absorption of O_3, the remaining gas occupied 41 mL volume. What is the molecular formula of ozone?

A. 3

B. 9

C. 90

D. 60

Answer: B

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15. At some temperature, the rate constant for the reaction of the type

$2A \rightarrow$ Products

is $0.08Ms^{-1}$. The time it takes for the concentration of A to drop from $1.50M \rightarrow 0.30M$ is

A. zero order, t= 7.5 sec

B. zero order , t= 15 sec

C. first order, t=22.5 sec

D. first order, t= 7.5 sec

Answer: B

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16. For the first order reaction $A(g) \rightarrow 2B(g) + C(g)$, the initial presuure is $P_A = 90mHg$, the pressure after 10 minutes is found to be $180mmHg$. The rate constant of the reaction is

A. $2 \times 10^{-3} \sec^{-1}$

B. $2 \times 10^{3} \sec^{-1}$

C. $1.15 \times 10^{-3} \sec^{-1}$

D. $1.15 \times 10^{3} \sec^{-1}$

Answer: C

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Exercise 2 H W Half Life

1. The half life for the reaction $N_2O_5 \Leftrightarrow 2NO_2 + \frac{1}{2}O_2$ in $24hr$ at $30^\circ C$. Starting with $10g$ of N_2O_5 how many grams of N_2O_5 will remain after a period of 96 hours ?

A. 1.25 g

B. 0.625 g

C. 1.77 g

D. 0.5 g

Answer: B

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2. The half life period of a first order reaction, A $\rightarrow$ Product is 10 minutes. In how much time is the concentration of A reduced to 10% of its original concentration?

A. 10 minutes

B. 33 minutes

C. 90 minutes

D. 70 minutes

Answer: B

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3. A first order reaction is half completed in 45 minutes. How long does it need $99.9\ \%$ of the reaction to be completed

A. $7\left(\frac{1}{2}\right)$ hours

B. 20 hours

C. 10 hours

D. 5 hours

Answer: A

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4. For the zeroth order reaction, sets I and II are given, hence x is :

A. 2 min

B. 3 min

C. 4 min

D. 6 min

Answer: D

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5. $A \to B, K_1 = 0.693\,\text{sec}^{-1}$

$C \to D, K_2 = 0.693\ \text{min}^{-1}$. If t_1 & t_2 are half lives of two reactions, then

A. $t_1 = t_2$

B. $t_1 = 60t_2$

C. $t_2 = 60t_1$

D. $t_2 = 2.303t_1$

Answer: C

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6. For $2NH_3(g) \xrightarrow[\Delta]{Pt}$ Products order kinetics. If $t_{1/2}$ at p = 4 atm is 25 sec, $t_{1/2}$ at p = 16 atm will be (in sec)

A. 6.25

B. 625

C. 100

D. $(25)^{1/4}$

Answer: C

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7. DDT on exposure to water decomposes according to first order kinetics. Half life = 10 years. How much time it will take for its decomposition to 99%?

A. 50 years

B. 66.6 years

C. 500 years

D. 666 years

Answer: B

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8. The rate of a first order reaction is 0.04 mol $\text{litre}^{-1}s^{-1}$ after 10 minutes and 0.03 mol $\text{litre}^{-1}s^{-1}$ after 20 minutes. Find the half life period of the reaction.

A. 2.406 min

B. 24.06 min

C. 240.6 min

D. 0.204 min

Answer: B

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9. $A + B \rightarrow$ Product

A. $1.386\,\text{sec}^{-1}$

B. $13.86\,\text{sec}^{-1}$

C. $26.72\,\sec^{-1}$

D. $2.672\,\sec^{-1}$

Answer: A

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10. The gas phase decomposition of dimethyl ether follows first order kinetics.

$CH_3 - O - CH_3(g) \rightarrow CH_4(g) + H_2(g) + CO(g)$

The reaction is carried out in a constant volume container at $500^\circ C$ and has a half life of $14.5\ \min$. Initially, only dimethyl ether is present at a pressure $0.40atm$. What is the total pressure of the system after $12\ \min$? (Assume ideal gas behaviour)

A. 0.946 atm

B. 0.785 atm

C. 0.777 atm

D. 0.749 atm

Answer: D

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11. The radioactive isotope ^{32}P decays by first order kinetics and has a half-life of 14.3 days. How long does it take for 95.0% of a given sample of 32 p to decay?

A. 21 days

B. 42 days

C. 62 days

D. 80 days

Answer: C

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12. 20% deocmposition of H_2O_2 in presence of an acid requires 5 min. The time required for 50% decomposition in minutes is

A. 15.52

B. 1.552

C. 0.1552

D. 7.76

Answer: A

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13. The first order rate constant for the decomposition of N_2O_5 is $6.2 \times 10^{-2}s^{-1}$. The half-life period for this decomposition is

A. 223.4 s

B. 1177.7s

C. 11.177s

D. 160.9 s

Answer: C

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Exercise 2 H W Collision Theory

1. The reaction $A \rightarrow C$ has activation energy for the forward and the backward reaction has 25 kJ and 32 KJ respectively. The ΔH for the reaction is

A. 57 KJ

B. $-57KJ$

C. 7 KJ

D. $-7KJ$

Answer: D

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2. Consider an endothermic reaction $X \to Y$ with the activation energies E_b and E_f for the backward and forward reaction, respectively. In general

A. $E_b < E_f$

B. $E_b > E_f$

C. $E_b = E_f$

D. There is no definite relation because E_b and E_f

Answer: A

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3. The rate constant of a reaction at 300 K is$1.6 \times 10^{-3}\,\mathrm{sec}^{-1}$ and at 310K it is $3.2 \times 10^{-3}\,\mathrm{sec}^{-1}$ the activation energy of the reaction approximately in kcals is

A. 41609

B. 20-25

C. 30-40

D. 40-50

Answer: A

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4. The rate constant, the activation energy and the Arrhenius parameter of a chemical reactions at $25^{\circ}C$ are $3.0 \times 10^{-4}s^{-}$, $104.4\,\mathrm{kJ\ mol^{-1}}$ and $6 \times 10^{14}s^{-1}$ respectively. The value of the rate constant as $T \to \infty$ is

A. $2.0 \times 10^{18}s^{-1}$

B. $6.0 \times 10^{14}s^{-1}$

C. Infinity

D. $3.6 \times 10^{30}s^{-1}$

Answer: B

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5. For an exothermic chemical process ocuuring in two process occuring in two steps as follows

$(i) A + B \to X(\text{slow}) \qquad (ii) X \to AB(\text{fast})$

The progress of reaction can be best described by :

A. 

B. 

C. 

D. None

Answer: C

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6. Given that the temperature coefficient for the saponification of ethylacetate by $NaOH$ is 1.75. Calculate the activation energy.

A. 1.0207 kcal

B. 10.207 kcal/mol1.0207 cal

C. 10.207 cal/mol

D. 149.5 kJ

Answer: B

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7. What is the activation energy for the decomposition of N_2O_5 as

$$N_2O_5 \Leftrightarrow 2NO_2 + \frac{1}{2}O_2$$

If the values of the rate constants are 3.45×10^{-5} and 6.9×10^{-3} at $27^\circ C$ and $67^\circ C$ respectively

A. 112.5 kJ

B. 200 kJ

C. 149.5 kJ

D. 11.25 kJ

Answer: A

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Exercise 3

1. A reaction proceeds by first order, 75% of this reactin was completed in 32 min. The time required for 50% completion is

A. 8 min

B. 16 min

C. 20 min

D. 24 min

Answer: B

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2. The temperature dependence of rate constant (k) of a chemical reaction is written in terms of Arrhenius equation, $k = Ae^{-E_a/RT}\Big)$ Activation energy (E_a) of the reaction can be calculate by plotting

A. $\log k$ vs $\frac{1}{T}$

B. $\log k$ vs $\frac{1}{\log T}$

C. k vs T

D. k vs 1/(log T)

Answer: A

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3. Rate of a reaction can be expressed by following rate expression, Rate = $K[A]^2[B]$, if conentration of A is incereased by 3 times and concentration of B is incereased by 2 times, how many times rate of reaction increses?

A. 9 times

B. 27 times

C. 18 times

D. 8 times

Answer: C

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4. If the volume of the vessel in which the reaction $2NO + O_2 \rightarrow 2NO_2$ is occurring is diminished to 1/3 rd of its initial volume . The rate of the reaction will be increased by

A. 3 times

B. 9 times

C. 27 times

D. 36 times

Answer: C

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5. The reaction obey I order with respect to H_2 and ICl both.

$H_2(g) + 2ICl(g) \rightarrow 2HCl(g) + I_2(g)$

Which of the following mechanism is in consistent with the given fact ?

Mechanism A: $H_2(g) + 2Cl \rightarrow 2HCl(g) + I_2(g)$

Mechanism B: (i) $H_2(g) + ICl(g) \xrightarrow{\text{slow}} HCl(g) + HI(g)$

(ii) $HI(g) + ICl(g) \rightarrow HCl(g) + I_2$

A. B only

B. A and B both

C. Neither A nor B

D. A only

Answer: B

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6. In a first order reaction $A \rightarrow B$, if k is rate constant and initial concentration o f the reactant A is 0.5 M then the half-life is

A. $\frac{0.693}{0.5K}$

B. $\frac{\log 2}{k}$

C. $\frac{\log 2}{k\sqrt{0.5}}$

D. $\frac{\ln 2}{k}$

Answer: D

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7. If 60% of a first order reaction was completed in 60 minutes, 50% of the same reaction would be completed in approximately (log 4 = 0.60 log 5 = 0.69)

A. 50 min

B. 45 min

C. 60 min

D. 40 min

Answer: B

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8. The half-life for the reaction 2.4h STP. Starting with 10.8g N_2O_5 how much oxygen will be obtained after a period of 9.6 h ?

A. 1.5 L

B. 3.36 L

C. 1.05 L

D. 0.07 L

Answer:

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9. Catalyst increses the rate of reaction

A. by decreasing E_a

B. by increasing E_a

C. by decreasing A

D. by increasing entropy

Answer: A

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10. Rate constant has the unit $\mathrm{mol}^{-2}L^{-2}s^{-1}$, then order of reaction is

A. zero order, t= 7.5 sec

B. first

C. second

D. third

Answer: D

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11. The reaction follows that the mechanism $A + B \xrightarrow{k_2} A + B$ (slow) then rate law is

A. r= k[A][B]

B. r=k[AB][B]

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

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

Answer: C

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12. For the reaction

$2HX \rightarrow H_2 + X_2$

$-\frac{d[HX]}{dt}$ = rate

A. rate w.r.t $HX = +\frac{1}{2}\frac{d[HX]}{dt}$

B. rate w.r.t $HX = -\frac{1}{2}\frac{d[HX]}{dt}$

C. rate w.r.t $HX = +\frac{d[HX]}{dt}$

D. rate w.r.t HX $= -\frac{d[HX]}{dt}$

Answer: B

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13. Consider the following statements The rate law for the acid catalysed hydrolosis of an ester being given as Rate $= k[H^+][\text{ester}] = k'[\text{ester}]$. If the acid concentration is doubled at constant ester concentration

1. The second order rate constant, k is doubled

2. The pseudo first order rate constant, k is doubled

3. The rate of the reaction is doubled Which of the above statements are correct

A. 1 and 2

B. 2 and 3

C. 1 and 3

D. 1,2 and 3

Answer: B

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14. A hypothetical reaction $A_2 + B_2 \rightarrow 2AB$ follows the mechanism as given below:

$A_2 \Leftrightarrow A + A(\text{fast})$

$A + B_2 \rightarrow AB + B$ (slow)

$A + B \rightarrow AB$ (fast)

The order of the overall reaction is

A. 2

B. 1

C. $1\left(\frac{1}{2}\right)$

D. 0

Answer: C

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15. Consider following two reactions

$A \rightarrow \text{Product}, \ = \frac{d[A]}{dt} = \ -k-(1)[A]^0$

$B \rightarrow \text{Product}, \ -\frac{d[B]}{dt} = k_2[B]$

k_1 and k_2 are expressed in terms of molarity $\left(\text{mol}L^{-1}\right.$ and time $\left.s^{-1}\right)$ as

A. $s^{-1}, Ms^{-1}L^{-1}$

B. Ms^{-1}, Ms^{-1}

C. $s^{-1}, M^{-1}s^{-1}$

D. Ms^{-1}, s^{-1}

Answer: D

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16. What is the order of a reaction which has a rate expression rate = $K[A]^{3/2}[B]^{-1}$

A. $\frac{3}{2}$

B. $\frac{1}{2}$

C. 0

D. $\frac{4}{2}$

Answer: B

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17. T_{50} of first order reaction is 10 min. starting with 10 mol^{-1} rate after 20 min is :

A. 0.0693 mol L^{-1} min^{-1}

B. $0.0693 \times 2.5 mol L^{-1} \min^{-1}$

C. $0.0693 \times 5 mol L^{-2} \min^{-1}$

D. $0.0693 \times 10 mol L^{-1} \min^{-1}$

Answer: B

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18. For a first order reaction, we obtain a straight line with positive slope, what we need to plot?

A. $-\log_{10}[A]$ vs t

B. $-\log_c[A]$ vs t

C. $\log_{10}[A] vs$ log t

D. [A] vs t

Answer: B

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19. The rate constant k_1 and k_2 for two different reactions are $10^{16}e^{-2000/T}$ and $10^{15}e^{-1000/T}$, respectively. The temperature at which $k_1 = k_2$ is

A. 1000 K

B. $\frac{2000}{2.303}K$

C. 2000 K

D. $\frac{1000}{2.303}K$

Answer: D

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20. The rate constant of a first order reaction at $27^\circ C$ is 10–3 min–1. The temperature coefficient of this reaction is 2. What is the rate constant (in min–1) at $17^\circ C$ for this reaction :-

A. 10^{-3}

B. 5×10^{-4}

C. 2×10^{-3}

D. 10^{-2}

Answer: B

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21. The concentration of a reactant X decreases from 0.1 M to 0.005 M in 40 min. If the reaction follows first order kinetics, the rate of the reaction when the concentration of X is 0.01 M will be

A. $1.73 \times 10^{4} M \text{ min}^{-1}$

B. $3.47 \times 10^{-4} M \text{ min}^{-1}$

C. $3.47 \times 10^{-5} M \text{ min}^{-1}$

D. $7.5 \times 10^{-4} M \text{ min}^{-1}$

Answer: D

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22. For a reversible reaction `A 

A. Activation energy of forward reaction is greater then backward reaction

B. The forward reaction is endothermic

C. The threshold energy is less than that of activation energy

D. The energy of activation of forward reaction is equal to the sum of heat of reaction and the energy of activation of backward reaction

Answer: C

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23. The plote between concentration versus time for a zero order reaction is represented by :

A. 

B. 

C. 

D. 

Answer: D

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24. For the reaction„ $2A + B \rightarrow C + D$, the order of reaction is

A. one with respect to [B]

B. two with respect to [A]

C. two with respect to [A]

D. three

Answer: D

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25. In the reaction

$$BrO^{-3}(aq) + 5Br^{-}(aq) + 6H^{+} \rightarrow 3Br_2(1) + 3H_2O(1)$$

The rate of appearance of bromine (Br_2) is related to rate of disapperance of bromide ions as folllwoing :

A. $\frac{d[Br_2]}{dt} = -\frac{5}{3}\frac{d[Br^-]}{dt}$

B. $\frac{d[Br_2]}{dt} = \frac{5}{3}\frac{d[Br^-]}{dt}$

C. $\frac{d[Br_2]}{dt} = \frac{3}{5}\frac{d[Br^-]}{dt}$

D. $\frac{d[Br_2]}{dt} = -\frac{3}{5}\frac{d[Br^-]}{dt}$

Answer: D

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26. For the reaction $A + B$ products, it is observed that:

(1) on doubling the initial concentration of A only, the rate of reaction is also doubled and

(2) on doubling te initial concentration of both A and B, there is a charge by a factor of 8 in the rate of the reaction.

The rate of this reaction is given by

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

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

C. rate = k[A][B]

D. rate $= k[A]^2][B]$

Answer: A

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27. $3BrO^- \rightarrow BrO_3^- + 3Br^-$

If

$-\frac{d[BrO^-]}{dt} = k_1[BrO^-]^2, +\frac{d[BrO_3^-]}{dt} = k_2[BrO^-]^2 + \frac{d[Br^-]}{dt} = k_3$

, the correct relation between k_1, k_2 and k_3 is

A. $3k_1 = k_2 = 2k_3$

B. $k_1 = 3k_2 = 1.5k_3$

C. $k_1 = k_2 = k_3$

D. $2k_1 = 3k_2 = k_3$

Answer: B

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28. For a reaction, the dimensions of rate constant are same as that of rate, hence order of reaction is

A. 0

B. 1

C. 2

D. 3

Answer: A

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29. For a first order reaction, the time required for 99.9% of the reaction to take place is nearly

A. 10 times that required for half o f the reaction

B. 100 times that required for two-thirds of the reaction

C. 10 times that required for one-fourth of the reaction

D. 20 times that required for half o f the reaction

Answer: A

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30. Rate of the given reaction,

(1) $A + B \xrightarrow{r_1 = 0.05} X$

(2) $X + B \xrightarrow{r_2 = 0.89} Y$

(3) $Y + A \xrightarrow{r_3 = 0.001} AY$

(4) $AY + B \xrightarrow{r_4 = 0.10} AYB$ will be determined by

A. Step 1 : because the reaction starts with the formation of X

B. Step 2 : because it is the fatest step

C. Step 3 : because it is the slowest step

D. Step 4 : because it ends the reaction

Answer: C

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31. Which of the following is the correct statement

A. Order of a reaction has always an integral value lt

B. Mechanism of a reactional proposed is always final

C. Zero order reactions are multi-step reactions

D. Order of reaction can be predicted even without knowing the rate law

Answer: D

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32. For an endothermic reaction energy of activation is E_a and enthlpy of reaction is ΔH (both in $kJ\mathrm{mol}^{-1}$). Minimum value of E_a will be

A. $< \Delta H$

B. $= \Delta H$

C. $> \Delta H$

D. 0

Answer: C

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33. The rate of the reaction

$2NO + CI_2 \rightarrow 2NOCI$

is given by the rate equation

$Rate = k[NO]^2[CI_2]$

The value of the rate constant can be increased by

A. increasing the temperature

B. increasing the concentration of NO

C. increasing the concentration of Cl_2

D. doing all of these

Answer: A

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34. For the reaction $N_2O_5 \rightarrow 2NO_2 + \frac{1}{2}O_2$, the rate of disappearance of N_2O_5 is $6.25 \times 10^{-3} \text{mol L}^{-1}s^{-1}$. The rate of formation of NO_2 and O_2 will be respectively.

A. $6.25 \times 10^{-3} molL^{-1}s^{-1}$ & $6.25 \times 10^{-3} molL^{-1}s^{-1}$

B. $1.25 \times 10^{-2} molL^{-1}s^{-1}$ &$3.125 \times 10^{-3} molL^{-1}s^{-1}$

C. $6.25 \times 10^{-3} molL^{-1}s^{-1}$ & $3.125 \times 10^{-3} molL^{-1}s^{-1}$

D. $1.25 \times 10^{-2} molL^{-1}s^{-1}$ &$6.25 \times 10^{-3} molL^{-1}s^{-1}$

Answer: B

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35. Which one of the following statements for the order of a reaction is incorrect ?

A. Order of reaction is always whole number

B. Order can be determined only experimentally

C. Order is not influenced- stoichiometric coefficient of the reactants

D. Order of reaction is sum of power to the concentration terms of reactants to express the rate of reaction

Answer: A

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36. The activation energy of a reaction can be determined from the slope of which of the following graphs ?

A. $\ln K vs \frac{1}{T}$

B. $\frac{T}{\ln K} vs \frac{1}{T}$

C. $\ln K vs T$

D. $\frac{\ln K}{T} vs T$

Answer: A

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37. When initial concentration of a reactant is doubled in a reaction, its half-life period is not affected. The order of the reaction is

A. second

B. more than zero but less than first

C. zero

D. first

Answer: D

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38. The rate constant of the reaction $A \rightarrow B$ is 0.6×10^{-3} mole per second. If the concentration of A is $5M$, then concentration of B after 20 minutes is:

A. 0.36 M

B. 0.72 M

C. 1.08 M

D. 3.60 M

Answer: B

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39. The rate of a first-order reaction is $0.04\text{mol L}^{-1}s^{-1}$ at 10 seconds and $0.03\text{mol L}^{-1}s^{-1}$ at 20 seconds after initiation of the reaction. The hlaf-life period of the reaction is :

A. 54.1 s

B. 24.1s

C. 34.1s

D. 44.1 s

Answer: B

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Exercise 4

1. The role of a catalyst is to change

A. gibbs energy o f reaction.

B. enthalpy o f reaction.

C. activation energy o f reaction.

D. equilibrium constant

Answer: C

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2. In the presence of a catalyst, the heat evolved or absorbed during the reaction:

A. increase

B. decreases.

C. remains unchanged.

D. may increase or decrease.

Answer: C

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3. Activation energy of a chemical reaction can be determined by:

A. determining the rate constant at standard temperature.

B. determining the rate constants at two tempeatures

C. determining probability of collision

D. using catalyst.

Answer: B

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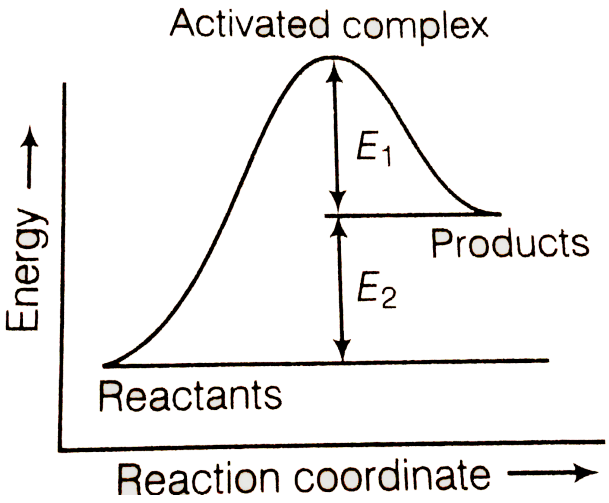
4. Consider figure and mark the correct option



A. Activation energy of forward reaction is $E_1 + E_2$ and product is less stable than reactant.

B. Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

C. Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.

D. Activation energy of backward reaction is El and product is more stable than reactant

Answer: A

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5. Consider a first order gas phase decomposition reaction given below:

$A(g) \rightarrow B_g + C_g$

The initial pressure of the system before decomposition of A was p_i. After lapse of time t'. Total pressure of the system increased by x units and became P_t. the rate constant k for the reaction is given as

A. $k = \frac{2.303}{t} \frac{\log p_1}{p_1 - x}$

B. $k = \frac{2.303}{t} \frac{\log p_i}{2p_i - p_i}$

C. $k = \frac{2.303}{t} \frac{\log p_i}{2p_i + p_i}$

D. $k = \frac{2.303}{t} \frac{\log p_i}{p_i + x}$

Answer: B

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6. According to Arrhenius equation rate constant K is equal to A $e.^{-E_a/RT}$. Which of the following options represents the graph of ln K vs $\frac{1}{T}$?

A. 

B. 

C. 

D. 

Answer: A

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7. Consider the Arrhenius equation given below and mark the correct option.

$k = Ae^{-\frac{Ea}{RT}}$

A. Rate constant increases exponentially with increasing activation energy and decreasing temperature

B. Rate constant decreases exponentially with increasing activation energy and decreasing temperature.

C. Rate constant increases exponentially with decreasing activation energy and decreasing temperature.

D. Rate constant increases exponentially with decreasing activation energy and increasing , temperature.

Answer: D

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8. Which of the following statement is not correct about order of a reaction ?

A. The order of a reaction can be a fractional number.

B. Order of a reaction is experimentally determined quantity.

C. the order of a reaction is always equal to the z sum of the stoichiometric coefficients o f reactants in the balanced chemical equation for a reaction,

D. The order of a reaction is the sum of the powers o f m olar concentration o f the reactants in the rate law expression

Answer: C

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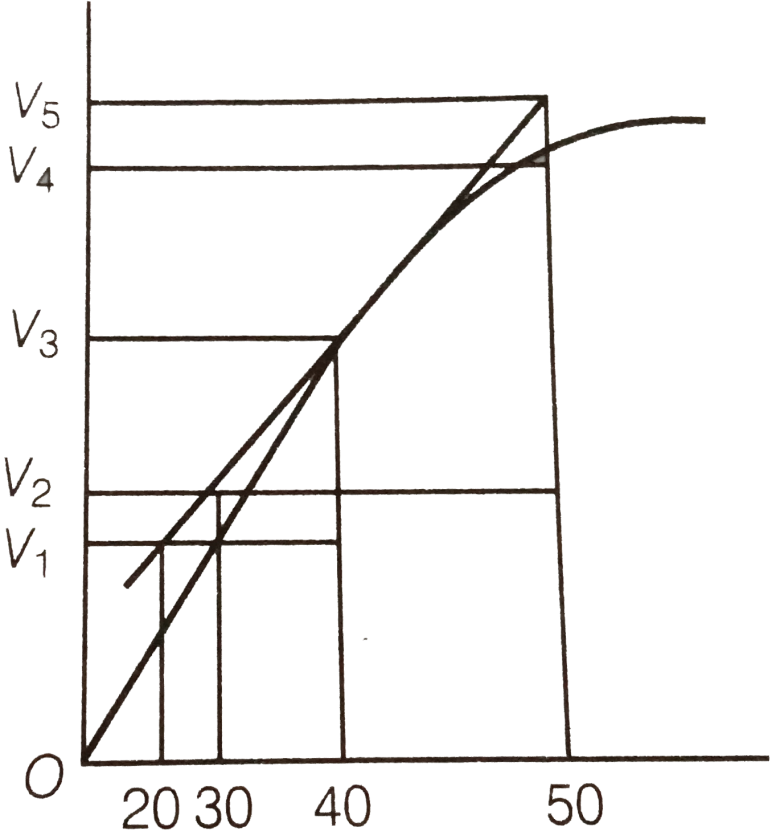
9. Consider the graph given in figure . Which of the following options does not show instantaneous rate of reaction at 40 ?



A. $\frac{V_5 - V_2}{50 - 30}$

B. $\frac{V_4 - V_2}{50 - 30}$

C. $\frac{V_3 - V_1}{40 - 30}$

D. $\frac{V_3 - V_1}{40 - 20}$

Answer: B

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10. Which of the following statements is correct?

A. The rate of a reaction decreases with passage of time as the concentration of reactants dereases

B. The rate of a reaction is same at any time during the reaction.

C. The rate of a reactio n is independent of temperature change.

D. The rate of a reaction decreases with increase in concentration of reactant(s)

Answer: A

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11. Which of the following expression is correct for the rate of reaction given below ?

$5Br^-(aq) + BrO_3^-(aq) + 6H^+(aq) \rightarrow 3Br_2(aq) + 3H_2O(l)$.

A. $\frac{?[Br^-]}{?t} = 5\frac{?[H^+]}{?t}$

B. $\frac{?[Br^-]}{?t} = \frac{6}{5}\frac{?[H^+]}{?t}$

C. $\frac{?[Br^-]}{?t} = \frac{5}{6}\frac{?[H^+]}{?t}$

D. $\frac{?[Br^-]}{?t} = 6\frac{?[H^+]}{?t}$

Answer: C

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12. Rate law for the reaction, $A + 2B \rightarrow C$ is found to be

Rate $= k[A][B]$

Concentration of reactant 'B' is doubled keeping the concentration of 'A' constant, the value of rate constant will be _____

A. the same

B. doubled

C. quadrupled

D. halved

Answer: B

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13. Which of the following statements is incorrect about the collison theory of chemical reaction?

A. it considers reacting molecules or atom s to be hard spheres and ignores their structural features/

B. Number of effective collisions determines the rate of reaction

C. Collision of atoms or molecules possessing sufficient threshold energy results into the product formation.

D. Molecules should collide with sufficient threshold energy and proper orientation for the collision to be effective

Answer: C

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14. A first order reaction is $50\,\%$ completed in 1.26×10^{14}s. How much time would it take for $100\,\%$ completion?

A. 1.26×10^{15}s

B. $2.52 \times 10^{14} s$

C. 2.52×10^{28}s

D. infinite

Answer: D

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15. Which of the following statements is not correct for the catalyst?

A. it catalyses the forward and backward reaction to the same extent.

B. It alters AG of the reaction.

C. It is a substance that does not change the equilibrium constant of a reaction.

D. It provides an alternate mechanism by reducing activation energy between reactants and products.

Answer: B

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16. The value of rate constant of a pseudo first order reaction

A. depends on the concentration of reactants present in small amount.

B. depends on the concentration of reactants present in excess.

C. is independent of the concentration of reactants.

D. depends only on temperature.

Answer: B

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17. Consider the reaction $A \rightarrow B$. The concentration of both the reactants and the products varies exponentially with time. Which of the following figure correctly describes the change in concentration of reactants and products with time ?

A. 

B. 

C. 

D. 

Answer: B

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18. The time for half-life period of a certain reaction, $A \rightarrow$ products is $1h$. When the initial concentration of the reactant $'A'$ is $2.0 \text{mol} L^{-1}$, how much time does it take for its concentration to come from 0.50 to $0.25 \text{mol} L^{-1}$, if it is zero order reaction ?

A. 4h

B. 0.5 h

C. 0.25 h

D. 1 h

Answer: C

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19. The rate of a chemical reaction doubles for every $10^{\circ}C$ rise of temperature. If the temperature is raised by $50^{\circ}C$, the rate of the reaction increases by about

A. 24 times

B. 32 times

C. 64 times

D. 10 times

Answer: B

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20. A reactant (A) forms two products $A \xrightarrow{K_1} B$, Activation energy $E_{a1} A \xrightarrow{K_1} C$, Activation energy E_{a2} If $E_{a1} = 2E_{a2}$, then K_1 and K_2 are related as

A. $K_1 = 2K_2 e^{K_{a2}/RT}$

B. $K_1 = K_2 e^{K_{a1}/RT}$

C. $K_2 = K_1 e^{E_{a2}/RT}$

D. $\frac{dC}{dt} = K[A][B]^2$

Answer: B

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21. For a reaction $1/2A \rightarrow 2B$, rate of disappearance of A is related to the rate of appearance of B by the expression:

A. $-\frac{d[A]}{dt} = \frac{1}{2}\frac{d[B]}{dt}$

B. $-\frac{d[A]}{dt} = \frac{1}{4}\frac{d[B]}{dt}$

C. $\frac{-d[A]}{dt} = \frac{d[B]}{dt}$

D. $-\frac{d[A]}{dt} = 4\frac{d[B]}{dt}$

Answer: B

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22. For the reaction A + 2B + C $\rightarrow$ D+2E the rate equation is rate = $K[A][B]^{\circ}[C]$ then the rate is

i) Doubled when [A] is doubled keeping B and C constant

ii) Doubled when [C] is doubled keeping A and B constant

iii) The same when [B] is doubled keeping A and C constant

iv) Doubled when |B] is doubled keeping A and C constant.

The correct combination is

A. I,ii,iii

B. All are correct

C. ii,iv

D. ii,iii,iv

Answer: A

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23. The acid hydrolysis of ester is: (i) first order reaction (ii) bimolecular reaction (iii) unimolecular reaction (iv) second order reaction The true statements are

A. I,ii

B. All are correct

C. ii,iv

D. ii,iii,iv

Answer: A

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24. Which of the following statements are correct: (i) law of mass action and rate law expressions - are same for single step reaction

(ii) the slowest step of a complex reaction gives the order of the complex reaction

(iii) both order and molecularity have normally a maximum value of 3

(iv) m olecularity of a com plex reaction $A + 2B \rightarrow C$ is 3

A. I,ii,iii

B. All are correct

C. ii,iv

D. ii,iii,iv

Answer: A

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25. Consider the following reactions at 300 K.

A $\rightarrow$ B (uncatalysed reaction)

$A \xrightarrow{\text{catalyst}} B$ (catalyst reaction)

The activation energy is lowered by 8.314KJ mol^{-1} for the catalysed reaction. How many times the rate of this catalysed reaction greater than that of uncatalysed reaction?(Given $e^{3.33} = 20$)

A. 28 times

B. 15 times

C. 25 times

D. 22 times that of uncatalysed reaction.

Answer: A

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26. A substan ce undergoes first order decomposition. The decomposition follows two parallel first order reaction as:

The percentage distribution of B and C are

A. 80% B and20% C

B. 76.83% B and 23.17% C

C. 90% B and 10%C

D. 60% B and 40% C

Answer: B

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27. The rate of the reaction between haemoglobin (Hb) and carbon monoxide (CO) was studied at20° C - The following data were collected with all concentration units in μ mol /L (A haemoglobin concentration of 2.21 μ mol/L is equal to 2.21×10^{-6} mol/L)

Determine the orders of this reaction with respect to Hb and CO and rate constant

A. 1st order in Hb and 1st order in CO 0.140 $L\mu mol^{-1}s^{-1}$

B. 1st order Hb and 1st order in CO 0.280 L $\mu mol^{-1}s^{-1}$

C. 1st order, 2nd order, 0.35 $L\mu mol^{-1}s^{-1}$

D. 2nd, order, 2nd order, 0.24 $L\mu mol^{-1}s^{-1}$

Answer: B

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28. Consider following (1) and (2):

The order of reaction and the value of rate constants is:

A. First order, $2.37 \times 10^{-5}\ \text{min}^{-1}$

B. Second order, $2.37 \times 10^{-5}\text{torr}^{-1}\ \text{min}^{-1}$

C. Zero order, $\text{torr}^{-1}\ \text{min}^{-1}$

D. None of the above

Answer: B

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29. Graph between log k and $\frac{1}{T}$ is a straight line with $OX = 5, \tan\theta \frac{1}{2.303}$. Hence E_a will be

A. $2.303 \times 2cal$

B. $\frac{5}{2.303}$ cal

C. 2 cal

D. none of these

Answer: C

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30. In a first order reaction the concentration of product 'x' at time 't' is given by the expression (a=initial concentration, k=rate constant, n=order)

A. $x = a\left(1 - e^{-kt}\right)$

B. $x = \frac{1}{a - x}$

C. $x = \frac{1}{2^{n-1}}$

D. $x = \frac{a}{a - x}$

Answer: A

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