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| Division | 12th |
| Subject | Chemistry |
| Chapter | Chemical Kinetics |
| Author | Ruhani kashni |
| Category | 03 |

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| Find the order of reaction if the rate of the reaction R = [P][Q]² and the reaction is P + 2Q  (2012) |
| 2 |
| 3 |
| 6 |
| 7 |
| b |
| Rate law is the expression in which reaction rate is given in term of Molar concentration of reactants with each term raised to some power which may or may not be same as the stoichiometric coefficient of the reaction species in a balanced chemical equation. |
| Order is the sum of the power of the concentrations terms in rate law expression  Order of reaction = 1+2 = 3 |
| Rate of a Chemical Reaction |

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| For a reaction P → Q the activation energy Ea is in forward direction. What will be the activation energy for reverse reaction  (2015) |
| Is negative of Ea |
| Double of Ea |
| It can be less than or more than Ea |
| None of the above |
| c |
| The given equation is Arrhenius equation k = A e⁻Ea/RT, Here A is the Arrhenius factor or the frequency factor. It is also called pre – exponential factor. R is a gas constant and Ea is a activation energy measured in joule/mole. |
| The nature of reaction is not given in the question so reaction can be exothermic or it can be endothermic so Ea for reverse reaction can be more or less. |
| Rate of a Chemical Reaction |

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| Which among the following can never involve two different reactants in the reaction  (2003) |
| First order reaction |
| Second order reaction |
| Unimolecular reaction |
| Bimolecular reaction |
| c |
| The number of reacting species taking part in an elementary reaction which must collide simultaneously in order to bring about chemical reaction is called molecularity of a reaction. |
| The molecularity of reaction is the number of reactant in molecules taking part in single step of the reaction thus, the reaction involving two different reactant can never be unimolecular. |
| Average rate |

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| What would be the reaction quotient 'Q' when two reactants E and F are mixed and they produce G and H  (2007) |
| Increases with time |
| Is zero |
| Is independent upon time |
| Decreases with time |
| a |
| Rate law is the expression in which reaction rate is given in term of Molar concentration of reactants with each term raised to some power which may or may not be same as the stoichiometric coefficient of the reaction species in a balanced chemical equation. |
| when two reactants E and F are mixed and they produce G and H the reaction quotient 'Q' increases with time  Q = [E][F]/[G][H] = Products/reactants  Q = increases with time |
| Average rate |

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| --- |
| Find the order of reaction for a reaction P→Q here when the concentration of P is increased by 1.5 the rate increases by the factor of 2.25  (2013) |
| 0 |
| 1 |
| 2 |
| 3 |
| c |
| Rate law is the expression in which reaction rate is given in term of Molar concentration of reactants with each term raised to some power which may or may not be same as the stoichiometric coefficient of the reaction species in a balanced chemical equation |
| let the rate law equation be  = r= k[P]ˣ………….(1)  2.25 × r = k[1.5P]ˣ…….(2)  By dividing (2) by (1)  We get, x= 2, so it is a second order reaction |
| Instantaneous rate |

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| A→ B is an endothermic reaction and it has activation energies equals to Eb and Ef for the backward and forward reaction, respectively. In general  (2016) |
| Eb> Ef |
| Eb < Ef |
| Eb= Ef |
| None of the above |
| b |
| Rate law is the expression in which reaction rate is given in term of Molar concentration of reactants with each term raised to some power which may or may not be same as the stoichiometric coefficient of the reaction species in a balanced chemical equation |
| Enthalpy of reaction (∆H) = Ea(f) – Ea (b)  For endothermic reaction ∆H = +be hence for ∆H to be positive  Ea(b) < Ea(f) |
| Instantaneous rate |

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| Which among the given options is true about first order reaction  (2002) |
| t1/2 is directly proportional to a |
| t1/2 is directly proportional to a° |
| t1/2 is inversely proportional to a |
| All of the above |
| b |
| If the concentration of the reactants of the reactants are increased the rate constant remains same because it doesn’t depend upon the concentration. |
| For the first order reaction t1/2 is directly proportional to a° because t1/2 is independent of the initial concentration. |
| Factors Influencing Rate of a Reaction |

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| For completing 60 percent of a first order reaction 60 minutes are needed, 50% of the Same reaction is completed in approximately  (2008) |
| 25 Min |
| 60 min |
| 55 Min |
| 45 min |
| d |
| the first order reaction  Half-life, t1/2 = 0.693/k |
| k = 2.303/60 log a/0.4a = 0.0153  t1/2 = 0.693/0.0153  = 45.3 min |
| Factors Influencing Rate of a Reaction |

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| For a zero-order reaction the plot of concentration Vs time is linear with  (2009) |
| +Ve slope and non-zero intercept |
| -ve slope and non-zero intercept |
| +Ve slope and zero intercept |
| -ve slope and zero intercept |
| b |
| A number of zero order reactions are known in which the rate of the reaction is independent of the concentration of the reactants. |
| For zero order reaction the rate constant is equals to =  = k = Co – C/t or Co – kt  The equation has negative plot and non-zero intercept. |
| Concentration |

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| For the reaction 3P→ 2Q what would be the rate of reaction +d[Q]/dt equals to  (2010) |
| -2/3d[P]/dt |
| -3/2d[P]/dt |
| -1/3 d[P]/dt |
| 3/2 d [Q]/dt |
| a |
| Rate law is the expression in which reaction rate is given in term of Molar concentration of reactants with each term raised to some power which may or may not be same as the stoichiometric coefficient of the reaction species in a balanced chemical equation |
| The given reaction is 3P→ 2Q  Rate of reaction = -1/3 dP/dt = ½ dQ/dt  = -2/3 dP/dt = dQ/dt |
| Concentration |

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| Find the order of reaction for a reaction whose half-life is found to be inversely proportional to the cube of initial concentration  (2011) |
| 1 |
| 0 |
| 3 |
| 4 |
| d |
| The half-life of a reaction is the time in which the concentration of a reactant is reduced to one half of its initial concentration. |
| t1/2 Is directly proportional to the a¹⁻ⁿ  =t1/2 ∝ 1/a³  Hence n = 4  So the order of reaction is 4 |
| Temperature |

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| Calculate the half-life period for first order reaction whose specific rate reaction is equals to 2.31 × 10⁻³ s⁻¹  (2016) |
| 200 sec |
| 300 sec |
| 400 sec |
| 500 sec |
| b |
| The half-life of a reaction is the time in which the concentration of a reactant is reduced to one half of its initial concentration. |
| Half-life period for first order reaction  = t1/2 = 0.693/k  = 0.694/2.31 × 10⁻³  = 300 sec |
| Temperature |

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| What would be the order of reaction when the rate of a gaseous reaction becomes half and this rate become half when the volume of the vessel is doubled  (2018) |
| 0 |
| 1 |
| 2 |
| 3 |
| b |
| order of reaction is an experimental quantity it can be zero or even a fraction but molecularity cannot be zero or a non-integer. |
| For the gaseous reaction P → Q(product)  Assume the order of reaction n, so  Rate = k[P]ⁿ  =r= k(p)ⁿ…………(1)  When the volume of vessel becomes double molar concentration becomes half. Since the rate becomes half, therefore  r/2 = kp/2)ⁿ…..(2)  2ⁿ = 2¹  =n = 1  Order = 1 |
| Catalyst |

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| For a reaction calculate the time taken to complete it’s 80% whereas 20% is completed in 10 minutes  (2014) |
| 50 min |
| 72.12 min |
| 75 min |
| 90 min |
| b |
| Rate law is the expression in which reaction rate is given in term of Molar concentration of reactants with each term raised to some power which may or may not be same as the stoichiometric coefficient of the reaction species in a balanced chemical equation |
| k = 2.303/10 log a/0.8a = 0.0223 /min  =t = 2.303/0.0223 log a/0.2 a  = 72.12 min |
| Catalyst |

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| t1/2 is directly proportional to a° in first order reaction because  (2009) |
| t1/2 depends upon initial concentration |
| t1/2 is independent upon the initial concentration |
| t1/2 is proportional to a |
| None of the above |
| b |
| If the concentration of the reactants of the reactants are increased the rate constant remains same because it doesn’t depend upon the concentration. |
| For the first order reaction t1/2 is directly proportional to a° because t1/2 is independent of the initial concentration. |
| Integrated Rate Equations |

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| The plot of log K against 1/T is straight line for the first order reaction. Find it’s slope  (2014) |
| -Ea/2.303 R |
| -2.303/Ea R |
| Ea / R |
| -Ea/2.303 |
| a |
| The given equation is Arrhenius equation k = A e⁻Ea/RT, Here A is the Arrhenius factor or the frequency factor. It is also called pre – exponential factor. R is a gas constant and Ea is a activation energy measured in joule/mole. |
| Arrhenius equation k = A e⁻Ea/RT  Log k = log A- Ea/2.303R .1/T  Equation of straight-line slope = - Ea/2.303R |
| Integrated Rate Equations |

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| Half-life period of first order reaction is 1386 seconds. The specific rate constant for the reaction is  (2017) |
| 0.5 × 10⁻³ s⁻¹ |
| 0.2 × 10⁻³ s⁻¹ |
| 2.5 × 10⁻³ s⁻¹ |
| 5.0 × 10⁻³ s⁻¹ |
| a |
| The half-life of a reaction is the time in which the concentration of a reactant is reduced to one half of its initial concentration. |
| For the first order reaction  Half-life, t1/2 = 0.693/k=k = 0.693/1386= 0.5 × 10⁻³ s⁻¹ |
| Temperature Dependence of the Rate of a Reaction |

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| It took 16 minutes to complete half of the reaction. What fraction of reaction will occur in 32 minutes  (2015) |
| 50% |
| 75% |
| 60% |
| 45 % |
| b |
| For the first order reaction  Half-life, t1/2 = 0.693/k |
| for the first order reaction t1/2 = 0.693/16 = 0.0433 min⁻¹  0.0433 = 2.303/32 log [A]o/[A]  Log [A]o/[A]= 0.6016  [A]o/[A] = 1/4  So 75 % of reaction would occur |
| Temperature Dependence of the Rate of a Reaction |

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| For an endothermic reaction energy of activation is Ea and enthalpy of reaction of ∆H (both of these in KJ/mol). Minimum value of Ea will be  (2011) |
| Equals to ∆H |
| Less than ∆H |
| More than ∆H |
| None of the above |
| a |
| The given equation is Arrhenius equation k = A e⁻Ea/RT, Here A is the Arrhenius factor or the frequency factor. It is also called pre – exponential factor. R is a gas constant and Ea is a activation energy measured in joule/mole. |
| For an endothermic reaction energy of activation is Ea and enthalpy of reaction of ∆H (both of these in KJ/mol). Minimum value of Ea will be equal to ∆H. |
| Collision Theory of Chemical Reaction |

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| For which order reaction collision theory is applicable  (2007) |
| 0 |
| 1 |
| 3 |
| Bimolecular reactions |
| d |
| order of reaction is an experimental quantity it can be zero or even a fraction but molecularity cannot be zero or a non-integer. |
| Bimolecular reaction refers to the chemical combination of two molecular entities in a reaction that can be considered either reversible or irreversible. |
| Collision Theory of Chemical Reaction |

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| 1/k[A]o is the half-life of which order  (2006) |
| 0 |
| 1 |
| 2 |
| 3 |
| c |
| The half-life of a reaction is the time in which the concentration of a reactant is reduced to one half of its initial concentration. |
| Half-life for the second order reaction is  t1/2 = 1/k[A]o  half-life of a reaction is the time in which the concentration of a reactant is reduced to one half of its initial concentration. |
| Definition of Molecularity of a reaction |

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| What is the unit of rate constant for third order reaction  (2005) |
| S⁻¹ |
| L²mol⁻²s⁻¹ |
| mol L⁻¹s⁻¹ |
| L²mol²s |
| b |
| order of reaction is an experimental quantity it can be zero or even a fraction but molecularity cannot be zero or a non-integer. |
| Rate = k[A]³  = mol L⁻¹/s = k(mol L⁻¹ )³  = k= 1/mol²L⁻²s  = L²mol⁻²s⁻¹ |
| Definition of Molecularity of a reaction |

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| What would be the rate of reaction if the rate constant is equal to the rate of reaction  (2011) |
| 0 |
| 1 |
| 2 |
| 3 |
| a |
| Order of reaction is independent upon the factors like temperature, pressure and volume and that’s why first order reaction doesn’t depend on any of these considerations. |
| Rate = K[A]°  Rate = k for zero order reaction  For zero order reaction the rate constant is equals to =  = k = Co – C/t or Co – kt |
| Definition of Rate law |

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| The half-life period for catalytic decomposition of AB3 at 50 mm Hg is 4hrs and at 100 mm Hg it is 2 hrs. The order of reaction is  (2008) |
| 0 |
| 1 |
| 2 |
| 3 |
| c |
| Order of reaction is independent upon the factors like temperature, pressure and volume and that’s why first order reaction doesn’t depend on any of these considerations. |
| t1/2 ∝ 1/(p)ⁿ⁻¹where n is the order of reaction  2/4 = (50/100)ⁿ ⁻¹  So, n= 2 |
| Definition of Rate law |

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| It took 60 minutes to complete 60% of the first order reaction. Find the time when Half of it is completed  (2015) |
| 20 min |
| 57.2 min |
| 45.3 min |
| 75 min |
| c |
| the first order reaction  Half-life, t1/2 = 0.693/k |
| k = 2.303/60 log a/0.4a = 0.0153  t1/2 = 0.693/0.0153  = 45.3 min |
| Specific rate constant |

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| The decomposition of formic acid on gold surface follows first order kinetics. If the rate constant at is and the activation energy , the rate constant at is \_\_ . (Round of to the Nearest Integer).  ( Given : )  (2021) |
| 9×105 |
| 10×10-5 |
| 8×10-3 |
| 7×10-4 |
| b |
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| Specific rate constant |

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| A and B decompose via first order kinetics with half-lives and 18.0 min respectively. Starting from an equimolar non reactive mixture of and , the time taken for the concentration of to become 16 times that of is min. (Round off to the Nearest Integer).  (2021) |
| 108 |
| 107 |
| 106 |
| 105 |
| a |
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| Integrated rate equations |

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| For a certain first order reaction of the reactant is left after . The rate constant of this reaction is . (Round off to the Nearest Integer).  [ Given : ]  (2021) |
| 1×10-2 |
| 2×10-3 |
| 3×10-3 |
| 4×10-2 |
| c |
|  |
|  |
| Integrated rate equations |

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| The reaction is an elementary reaction.  For a certain quantity of reactants, if the volume of the reaction vessel is reduced by a factor of 3 , the rate of the reaction increases by a factor of . (Round off to the Nearest Integer).  (2021) |
| 34 |
| 27 |
| 12 |
| 6 |
| b |
| concept of reaction order. |
| To determine the effect of changing the volume on the rate of the reaction, we can use the concept of reaction order. The reaction order is the exponent to which the concentration of a reactant is raised in the rate equation. In this case, let's assume the reaction is first order with respect to both A and B2. |
| Zero order reaction |

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| A reaction has a half life of . The time required for completion of the reaction is min. (Round off to the Nearest integer) [Use ]  (2021) |
| 10 |
| 20 |
| 30 |
| 40 |
| a |
| Half-life of a reaction is the time it takes for the reactant concentration to decrease by half. |
| The half-life of a reaction is the time it takes for the reactant concentration to decrease by half. |
| Zero order reaction |

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| Which of the following is a characteristic of a first-order reaction?  (2011) |
| The reaction rate is independent of temperature. |
| The reaction rate is dependent on the stoichiometric coefficients of the reactants. |
| The reaction rate is determined solely by the concentration of the reactant. |
| The reaction rate is unaffected by the presence of a catalyst. |
| c |
| first-order reaction |
| In a first-order reaction, the reaction rate is determined solely by the concentration of the reactant. The rate constant for a first-order reaction is independent of temperature and stoichiometric coefficients, and it remains constant throughout the reaction. |
| First order reaction |

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| For a first-order reaction, the half-life is independent of:  (2006) |
| Initial concentration of the reactant. |
| Temperature. |
| Rate constant. |
| Catalyst presence. |
| a |
| Half-life of a first-order reaction. |
| The half-life of a first-order reaction is independent of the initial concentration of the reactant. The half-life depends solely on the rate constant of the reaction and remains constant regardless of the initial concentration. |
| First order reaction |

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| Assertion: A third-order reaction has a rate equation of the form rate = k[A]3.  Reason: The rate of a third-order reaction is directly proportional to the cube of the concentration of the reactant.  (2010) |
| Both the assertion and the reason are true, and the reason is a correct explanation of the assertion. |
| Both the assertion and the reason are true, but the reason is NOT a correct explanation of the assertion. |
| The assertion is true, but the reason is false. |
| The assertion is false, but the reason is true. |
| b |
| Rate of a third-order reaction is not directly proportional to the cube of the concentration of the reactant |
| The assertion is true because the rate equation for a third-order reaction is indeed of the form rate = k[A]3. However, the reason is not a correct explanation because the rate of a third-order reaction is not directly proportional to the cube of the concentration of the reactant. Instead, the rate depends on the product of the concentrations of three reactants. |
| Third order reaction |

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| Assertion: The unit of the rate constant for a third-order reaction is M-2·s -1  Reason: The rate constant is determined by the slope of the rate-concentration plot.  (2013) |
| Both the assertion and the reason are true, and the reason is a correct explanation of the assertion. |
| Both the assertion and the reason are true, but the reason is NOT a correct explanation of the assertion. |
| The assertion is true, but the reason is false. |
| The assertion is false, but the reason is true. |
| b |
| Third-order reaction. |
| The assertion is true because the unit of the rate constant for a third-order reaction is indeed  M-2·s-1. However, the reason is not a correct explanation because the rate constant is not determined by the slope of the rate-concentration plot. Instead, it is determined experimentally by comparing the rate of the reaction with the concentrations of the reactants. |
| Third order reaction |

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| The half-life of a first-order reaction is 20 minutes. What fraction of the reactant will remain after 40 minutes?  (2009) |
| 1/2 |
| 1/4 |
| 1/8 |
| 1/16 |
| c |
| First-order reaction |
| In a first-order reaction, the fraction of the reactant remaining after a given time is given by the equation:    Since the half-life of the reaction is 20 minutes, after 40 minutes (which is two half-lives), the fraction remaining is (1/2)2=1/4  Therefore, 1/4 or 25% of the reactant will remain, which is 1/8 |
| Half-life of a reaction |

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| Which of the following factors can affect the half-life of a reaction?  (2012) |
| Pressure |
| Temperature |
| Catalysts |
| Volume |
| b |
| half-life of a reaction |
| The half-life of a reaction can be influenced by various factors. However, among the options provided, temperature has a significant impact on the reaction rate and, consequently, the half-life. According to the Arrhenius equation, the rate constant (k) of a reaction is exponentially dependent on the temperature (T) of the system:  k = A × exp(-Ea / RT) |
| Definition of half-life of a reaction |

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| Assertion (A): The half-life of a zero-order reaction is directly proportional to the initial concentration of the reactant.  Reason (R): In a zero-order reaction, the rate of reaction remains constant throughout, leading to a linear decrease in concentration over time.  (2019) |
| Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A). |
| Both Assertion (A) and Reason (R) are true, but Reason (R) is NOT the correct explanation of Assertion (A). |
| Assertion (A) is true, but Reason (R) is false. |
| Assertion (A) is false, but Reason (R) is true. |
| c |
| zero-order reaction |
| Assertion (A) is true: In a zero-order reaction, the rate of reaction is independent of the initial concentration of the reactant. This means that no matter what the initial concentration is, the rate of the reaction will remain constant. As the reaction progresses, the concentration of the reactant decreases linearly over time. Since the half-life is the time taken for the concentration to reduce to half of its initial value, it will be directly proportional to the initial concentration.  Reason (R) is false: The reason given states that the rate of reaction remains constant throughout a zero-order reaction, leading to a linear decrease in concentration over time. This statement is incorrect. In a zero-order reaction, the rate of reaction is constant, but the decrease in concentration is not linear; it is more accurately described as an exponential decrease. |
| Half-life of a zero order reaction |

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| In a zero-order reaction, if the initial concentration of the reactant is halved, how will it affect the half-life of the reaction?  (2016) |
| The half-life will remain unchanged. |
| The half-life will become half of its original value. |
| The half-life will double its original value. |
| The half-life will become four times its original value. |
| d |
| zero-order reaction |
| In a zero-order reaction, the half-life (t1/2) is directly proportional to the initial concentration of the reactant ([A]0). If the initial concentration is halved, the half-life will also be halved. if the initial concentration of the reactant is halved in a zero-order reaction, the half-life of the reaction will become half of its original value. This means the reaction will reach the halfway point in half the time it would have taken with the original initial concentration. |
| Half-life of a zero order reaction |

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| Assertion (A): The half-life of a first-order reaction remains constant, regardless of the initial concentration of the reactant.  Reason (R): In a first-order reaction, the rate of reaction is directly proportional to the concentration of the reactant.  (2013) |
| Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of Assertion (A). |
| Both Assertion (A) and Reason (R) are true, but Reason (R) is NOT the correct explanation of Assertion (A). |
| Assertion (A) is true, but Reason (R) is false. |
| Assertion (A) is false, but Reason (R) is true. |
| a |
| half-life of a first-order reaction |
| Assertion (A) is true: The half-life of a first-order reaction is constant and does not depend on the initial concentration of the reactant. In a first-order reaction, the rate constant (k) remains constant, and the rate of reaction is directly proportional to the concentration of the reactant. As the reaction proceeds, the concentration of the reactant decreases, but the rate of the reaction remains constant. Therefore, the time required for the reactant concentration to decrease to half its initial value (i.e., the half-life) remains the same.  Reason (R) is the correct explanation of Assertion (A): The rate of a first-order reaction is expressed as follows:  Rate = k[A]  Where [A] is the concentration of the reactant, and "k" is the rate constant. The rate of the reaction is directly proportional to the concentration of the reactant, meaning that as the concentration decreases over time, the rate of reaction also decreases proportionally. This directly leads to the constant half-life observed in first-order reactions since the rate of change of concentration with time is constant. |
| Half-life of a first order reaction |

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| The concept of half-life is used to describe the time taken for a reaction to:  (2007) |
| Reach equilibrium |
| Complete 50% of the reaction. |
| Reach maximum product formation. |
| Attain zero order. |
| b |
| Half-life of a reaction |
| The half-life of a reaction is the time required for 50% of the initial reactant to be consumed and converted into products. It is an essential parameter used to describe the kinetics of first-order reactions. |
| Half-life of a first order reaction |

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| The activation energy in the collision theory represents:  (2011) |
| The energy required to initiate a reaction. |
| The energy released during a reaction. |
| The energy difference between reactants and products. |
| The energy gained from the surroundings during a reaction. |
| a |
| Activation energy |
| Activation energy is the minimum amount of energy required for a chemical reaction to start and for the reactant molecules to transform into the activated complex. It is the energy barrier that must be overcome for the reaction to proceed. |
| Concept of collision theory |

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| Which of the following statements is true regarding the collision theory  (2012) |
| All collisions between reactant molecules lead to a successful reaction. |
| The rate of a reaction is solely determined by the number of collisions that occur. |
| Increasing the concentration of reactants has no effect on the reaction rate. |
| A successful collision is one where the reactant molecules collide in any random orientation. |
| d |
| collision theory |
| In the collision theory, a successful collision is defined as one where the reacting molecules collide with the proper spatial orientation, allowing the necessary bonds to form or break. The molecules do not necessarily need to collide with specific alignment or direction. The orientation factor, represented by the symbol "P" in the collision theory equation, considers the fraction of collisions with the proper orientation. |
| Concept of collision theory |

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| In a chemical reaction, the activation energy represents:  (2005) |
| The difference in energy between the products and reactants. |
| The energy released during the reaction. |
| The energy absorbed from the surroundings. |
| The energy required to initiate the reaction. |
| d |
| Activation energy |
| Activation energy is the energy required to initiate a chemical reaction, specifically to reach the transition state or activated complex where the reactant molecules are in an intermediate, unstable arrangement before forming products. |
| Concept of Activation energy |

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| If a reaction has a high activation energy, it implies that:  (2003) |
| The reaction is very slow. |
| The reaction is exothermic. |
| The reaction will never occur. |
| The reaction rate is not affected by temperature. |
| a |
| Activation energy |
| A high activation energy indicates that the reaction has a significant energy barrier that must be overcome for the reaction to take place. As a result, the reaction rate is relatively slow because only a small fraction of reactant molecules possess enough energy to surpass the activation energy barrier. |
| Concept of Activation energy |

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| Assertion: The activation energy diagram illustrates the energy changes that occur during a chemical reaction.  Reason: The reactants are at a higher energy level than the products on the activation energy diagram  (2011) |
| Both the assertion and reason are correct, and the reason is the correct explanation of the assertion. |
| Both the assertion and reason are correct, but the reason is NOT the correct explanation of the assertion. |
| The assertion is correct, but the reason is incorrect. |
| The assertion is incorrect, but the reason is correct. |
| a |
| Also known as the energy profile or reaction coordinate diagram. |
|  Assertion: The activation energy diagram (also known as the energy profile or reaction coordinate diagram) is a graph that shows the energy changes that occur during a chemical reaction.   Reason: The reactants are at a higher energy level than the products on the activation energy diagram. This is because the reaction starts with the reactants, and in order to form products, the reactant molecules need to overcome the energy barrier called activation energy. As the reaction progresses, the energy decreases, and the products are formed at a lower energy level compared to the reactants. |
| Activation Energy Diagram |

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| Assertion: A catalyst lowers the activation energy of a chemical reaction.  Reason: Catalysts increase the energy released during the reaction, leading to a reduction in activation energy.  (2018) |
| Both the assertion and reason are correct, and the reason is the correct explanation of the assertion. |
| Both the assertion and reason are correct, but the reason is NOT the correct explanation of the assertion. |
| The assertion is correct, but the reason is incorrect. |
| The assertion is incorrect, but the reason is correct. |
| b |
| Activation energy of a chemical reaction |
| The assertion is correct as catalysts do lower the activation energy of a chemical reaction, thereby increasing the reaction rate. However, the reason is incorrect. Catalysts do not increase the energy released during the reaction; instead, they provide an alternative reaction pathway with a lower activation energy, making it easier for the reaction to occur.  Assertion: Increasing the temperature of a reaction increases the rate of reaction due to a decrease in activation energy. Reason: Higher temperatures cause an increase in the concentration of reactant molecules, leading to more frequent collisions with sufficient energy to overcome the activation energy barrier. |
| Activation Energy Diagram |

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| Which of the following statements is true regarding the Arrhenius equation?  (2006) |
| The Arrhenius equation predicts a linear relationship between the rate constant (k) and temperature (T). |
| The activation energy (Ea) is inversely proportional to the rate constant (k). |
| The pre-exponential factor (A) is independent of temperature. |
| The Arrhenius equation is only applicable to first-order reactions. |
| a |
| Arrhenius equation |
| The Arrhenius equation, when plotted in the form of the Arrhenius plot (ln k vs. 1/T), shows a linear relationship. This linear relationship allows the determination of activation energy (Ea) and the pre-exponential factor (A) from the slope and y-intercept of the graph, respectively. |
| Arrhenius equation |

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| A reaction with a higher activation energy will have  (2010) |
| A higher rate constant at all temperatures |
| A lower rate constant at all temperatures. |
| No effect on the rate constant at any temperature. |
| A higher rate constant at higher temperatures but lower rate constant at lower temperatures. |
| d |
| Higher activation energy. |
| A reaction with a higher activation energy will have a higher rate constant at higher temperatures due to the exponential dependence of the Arrhenius equation on temperature (e^(−Ea/RT)). However, at lower temperatures, the rate constant will be lower compared to reactions with lower activation energy. |
| Arrhenius equation |