JEE MAIN ADVANCED
ENGINEERING

CHEMICA POINT

A Challenge in Chemistry

NEET AIIMS JIPMER
MEDICAL

Chemical Kinetic

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1. The following results were obtained during kinetic studies of the reaction; $2A+B\longrightarrow$ Products

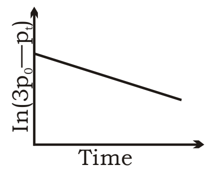
Experiment	[A] (in mol L^{-1})	[B] (in mol L^{-1})	Initial rate of reaction (in mol L^{-1} min^{-1})
I.	0.10	0.20	6.93×10^{-3}
II.	0.10	0.25	6.93×10^{-3}
III.	0.20	0.30	1.386×10^{-2}

The time (in minutes required to consume half of A is:
(a) 5
(b) 10
(c) 100
(d) 1 **(JEE Main-2019)**

2. For the reaction, $2A+B\longrightarrow$ Products. When concentration of both (A and B) becomes double, then rate of reaction increases from 0.3 mol $L^{-1}s^{-1}$ to 2.4 mol $L^{-1}s^{-1}$. When concentration of only A is doubled, the rate of reaction increases from 0.3 mol $L^{-1}s^{-1}$ to 0.6 mol $L^{-1}s^{-1}$. Which of the following is true? **(JEE Main-2019)**
(a) The whole reaction is of 4th order
(b) The order of reaction w.r.t. B is one
(c) The order of reaction w.r.t. B is 2
(d) The order of reaction w.r.t. A is 2

3. At 518^0C, the rate of decomposition of a sample of gaseous acetaldehyde, initially at a pressure of 363 Torr, was 1.00 Torr s^{-1} when 5% had reacted and 0.5 Torr s^{-1} when 33% had reacted. The order of the reaction is: **(JEE Main-2018)**
(a) 2
(b) 3
(c) 1
(d) 0

4. For a first order reaction $A(g)\longrightarrow 2B(g)+C(g)$ at constant volume and 300 K, the total pressure at the beginning (t = 0) and at time *t* are p_0 and p_v respectively. Initially, only A is present with concentration $[A]_0$, and $t_{1/3}$ is the time required for the partial pressure of A to reach 1/3rd of its initial value. The correct option(s) is(are) (Assume that all these gases behave as ideal gases) **(IIT 2018)**

(a)


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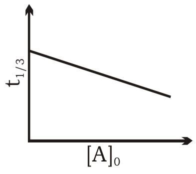
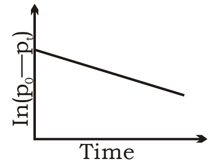
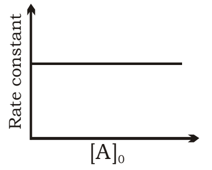


(c)


(d)


5. In a bimolecular reaction, the steric factor P was experimentally determined to be 4.5, the correct option(s) among the following is(are) **(JEE Adv. 2017)**
(a) The activation energy of the reaction is unaffected by the value of the steric factor
(b) Experimentally determined value of frequency factor is higher than that predicted by Arrhenius equation
(c) The value of frequency factor predicted by Arrhenius equation is h igher than that determined experimentally
(d) Since P = 4.5, the reaction will not proceed unless an effective catalyst is used.

6. Two reactions R_1 and R_2 have identical pre-exponential factors. Activation energy of R_1 exceeds that of R_2 by 10 kJ mol^{-1}. If k_1 and k_2 are rate constants for reactions R_1 and R_2, respectively at 300 K, then in $\left(\frac{k_2}{k_1}\right)$ is equal to (R = 8.314 J $mol^{-1}K^{-1}$) **(JEE Main 2017)**
(a) 8
(b) 12
(c) 6
(d) 4

7. According to the Arrhenius equation, **(JEE Adv. 2016)**
(a) a high activation energy usually implies a fast reaction
(b) rate constant increases with increase in temperature. This is due to a greater number of collisions whose energy exceeds the activation energy
(c) higher the magnitude of activation energy, stronger is the temperature dependence of the rate constant
(d) the pre-exponential factor is a measure of the rate at which collisions occur, irrespective of their energy.

8. Decomposition of H_2O_2 follows a first order reaction. In 50 min, the concentration of H_2O_2 decreases from 0.5 to 0.125 M in one such decomposition. When the concentration of H_2O_2 reaches 0.05 M, the rate of formation of O_2 will be: **(JEE Main-2016)**
(a) 6.93×10^{-4} mol min^{-1}
(b) 2.66 L min^{-1} at STP
(c) 1.34×10^{-2} mol min^{-1}
(d) 6.93×10^{-2} mol min^{-1}

9. Higher order (>3) reactions are rate due to **(JEE Main-2015)**
(a) low probability of simultaneous collision of all the reacting species
(b) increase in entropy and activation energy as more molecules are involved
(c) shifting of equilibrium towards reactants due to elastic collisions.
(d) loss of active species on collision

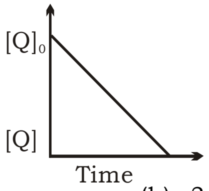
10. For the elementary reaction, $M \xrightarrow{} N$, the rate of disappearance of *M* increases by a factor of 8 upon doubling the concentration of M. The order of the reaction with respect to M is: **(JEE Adv.-2014)**
(a) 4 (b) 3 (c) 2 (d) 1

11. For the non-stoichiometric reaction, $2A + B \xrightarrow{} C + D$, the following kinetic data were obtained in three separate experiments, all at 298 K.

Initial concentration *(A)*	**Initial concentration** *(B)*	**Initial rate of formation of C** (mol $L^{-1}s^{-1}$)
0.1 M	0.1 M	1.2×10^{-3}
0.1 M	0.2 M	1.2×10^{-3}
0.2 M	0.1 M	2.4×10^{-3}

The rate law for the formation of C is **(JEE Main-2014)**
(a) $\frac{dc}{dt} = k[A][B]$ (b) $\frac{dc}{dt} = k[A]^2[B]$
(c) $\frac{dc}{dt} = k[A]\ [B]^2$ (d) $\frac{dc}{dt} = k[A]$

12. In the reaction, $P + Q \xrightarrow{} R + S$, the time taken for 75% reaction of *P* is twice the time for 50% reaction of *P*. The concentration of *Q* varies with reaction time as shown in the figure. The overall order of the reaction is: **(JEE Adv.-2013)**



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

13. The rate of a reaction double when its temperature changes from 300 K to 310 K. Activation energy of such a reaction will be (R = 8.314 J $K^{-1}mol^{-1}$ and log 2 = 0.301) **(JEE Main-2013)**
(a) 53.6 kJ mol^{-1} (b) 48.6 kJ mol^{-1}
(c) 58.5 kJ mol^{-1} (d) 60.5 kJ mol^{-1}

14. For a first order reaction, $(A) \xrightarrow{}$ products the concentration of A changes from 0.1 M to 0.025 M in 40 min. The rate of reaction when the concentration of A is 0.01 M is **(AIEEE 2012)**
(a) 1.73×10^{-5} M/min (b) 3.47×10^{-4} M/min
(c) 3.47×10^{-5} M/min (d) 1.73×10^{-4} M/min

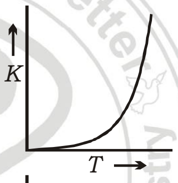
15. For the first order reaction, **(IIT 2011)**
$2N_2O_5(g) \xrightarrow{} 4NO_2(g) + O_2(g)$
(a) the concentration of the reactant decreases exponentially with time
(b) the half-life of the reaction decreases with increasing temperature
(c) the half-life of the reaction depends on the initial concentration of the reactant
(d) the reaction proceeds of 99.6% completion in eight half-life duration.

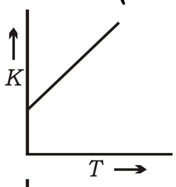
16. The rate of a chemical reaction doubles for every 10^0C rise of temperature. If the temperature is raised by 50^0C, the rate of the reaction increases by about **(AIEEE 2011)**
(a) 10 times (b) 24 times
(c) 32 times (d) 64 times

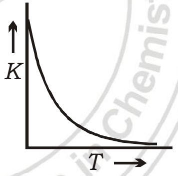
17. A reactant (A) forms two products
$A \xrightarrow{k_1} B$, Activation energy E_{a_1}
$A \xrightarrow{k_2} C$, Activation energy E_{a_2}
If $E_{a_2} = 2E_{a_1}$, then k_1 and k_2 are related as **(AIEEE 2011)**
(a) $k_1 = 2k_2 e^{E_{a_2}/RT}$ (b) $k_1 = k_2 e^{E_{a_1}/RT}$
(c) $k_2 = k_1 e^{E_{a_2}/RT}$ (d) $k_1 = Ak_2 e^{E_{a_1}/RT}$

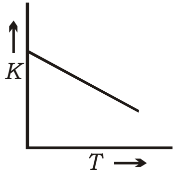
18. The time for half-life period of a certain reaction, $A \xrightarrow{}$ products in 1h. When the initial concentration of the reactant 'A' is 2.0 mol L^{-1}, h ow much time does it take for its concentration to come from 0.50 to 0.25 mol L^{-1}, if it is a zero order reaction? **(AIEEE 2010)**
(a) 4 h (b) 0.5 h
(c) 0.25 h (d) 1 h

19. Plots showing the variation of the rate constant (*k*) with temperature (*T*) are given below. The plot that follows Arrhenius equation is: **(IIT - 2010)**

(a)


(b)


(c)


(d)


20. For a first order reaction, $A \to P$, the temperature (T) dependent rate constant (*k*) was found to follow the equation: $\log k = \frac{2000}{T} + 6.0$
the pre-exponential factor *A* and the activation energy E_a, respectively, are **(IIT 2009)**
(a) $1.0 \times 10^6\ s^{-1}$ and 9.2 kJ mol^{-1}
(b) 6.0 s^{-1} and 16.6 kJ mol^{-1}
(c) $1.0 \times 10^6\ s^{-1}$ and 16.6 kJ mol^{-1}
(d) $1.0 \times 10^6\ s^{-1}$ and 38.3 kJ mol^{-1}

21. 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) **(AIEEE 2009)**
(a) 230.3 min (b) 23.03 min
(c) 46.06 min (d) 460.6 min

22. For a reaction $\frac{1}{2}A \xrightarrow{} 2B$, rate of disappearance of 'A' is related to the rate of appearance of 'B' by the expression **(AIEEE 2008)**
(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) $-\dfrac{d[A]}{dt}=\dfrac{d[B]}{dt}$ (d) $-\dfrac{d[A]}{dt}=4\dfrac{d[B]}{dt}$

23. Under the same reaction conditions, initial concentration of 1.386 mol dm^{-3} of a substance becomes half in 40 s and 20 s through first order and zero order kinetics respectively. Ratio $\left(\dfrac{k_1}{k_0}\right)$ of the rate constants for first order (k_1) and zero order (k_0) of the reaction is **(IIT - 2008)**
(a) 0.5 mol^{-1} dm^{3} (b) 1.0 mol dm^{-3}
(c) 1.5 mol dm^{-3} (d) 2.0 mol^{-1} dm^{3}

24. Consider a reaction, $aG+bH\rightarrow$ products. When concentration of both the reactants G and H is doubled, the rate increases by eight times. However, when concentration of G is doubled keeping the concentration of H fixed, the rate is doubled. The overall order of the reaction is **(IIT 2007)**
(a) 0 (b) 1 (c) 2 (d) 3

25. Consider the reaction, $2A+B\longrightarrow$ product. 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 u nit of rate constnat for this reaction is **(AIEEE 2007)**
(a) L mol^{-1}s^{-1} (b) no unit
(c) mol L^{-1}s^{-1} (d) s^{-1}

26. The energies of activation for forward and reverse reactions for $A_2+B_2 \rightleftharpoons 2AB$ are 180 kJ mol^{-1} and 200 kJ mol^{-1}, respectively. The presence of a catalyst lowers the activation energy of both (forward and reverse) reactions by 100 kJ mol^{-1}. The enthalpy changes of the reaction $(A_2+B_2\rightarrow 2AB)$ in the presence of catalyst will be (in kJ mol^{-1}) **(AIEEE 2007)**
(a) 300 (b) 120
(c) 280 (d) 20

27. A radioactive element gets spilled over the floor of a room. Its half-life period is 30 days. If the initial activity is ten times the permissible value, after how many days will it be safe to enter the room? **(AIEEE 2007)**
(a) 1000 days (b) 300 days
(c) 10 days (d) 100 days

28. The following mechanism has been proposed for the reaction of NO with Br$_2$ to form NOBr
$NO(g)+Br_2(g) \rightleftharpoons NOBr_2(g)$
$NOBr_2(g)+NO(g)\longrightarrow 2NOBr(g)$
If the second step is the rate determining step, the order of the reaction with respect to NO(g) is **(AIEEE 2006)**
(a) 1 (b) 0
(c) 3 (d) 2

29. Rate of a reaction can be expressed by Arrhenius equation as $k=Ae^{-E/RT}$ In this equation, E represents **(AIEEE 2006)**
(a) the energy above which all the colliding molecules will react
(b) the energy below which colliding molecules will not react
(c) the total energy of the reacting molecules at a temperature, T
(d) the fraction of molecules with energy greater than the activation energy of the reaction.

30. 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 unchanged (b) triple **(AIEEE 2006)**
(c) increase by a factor of 4 (d) double

31. Which one of the following statement(s) is incorrect about order of reaction? **(IIT 2005)**
(a) Order of reaction is determined experimentally
(b) Order of reaction is equal to sum of the power of concentration terms in differential rate law.
(c) It is not affected with stoichiometric coeffcient of the reactants.
(d) Order cannot be fractional

32. A reaction involving two different reactants can never be **(AIEEE 2005)**
(a) bimolecular reaction (b) second order reaction
(c) first order reaction (d) unimolecular reaction

33. t$_{1/4}$ can be taken as the time taken for the concentration of a reactant to drop to 3/4 of its initial value. If the rate constant for a first order reaction is k, the t$_{1/4}$ can be written as **(AIEEE 2005)**
(a) $0.75/k$ (b) $0.69/k$
(c) $0.29/k$ (d) $0.10/k$

34. (A) follows first order reaction, (A) $\rightarrow$ product. Concentration of A, changes from 0.1 M to 0.025 M in 40 min. Find the rate of reaction of A when concentration of A is 0.01 M. **(IIT 2004)**
(a) 3.47 × 10^{-4} M min^{-1} (b) 3.47 × 10^{-5} M min^{-1}
(c) 1.73 × 10^{-4} M min^{-1} (d) 1.73 × 10^{-5} M min^{-1}

35. The rate equation for the reaction $2A+B\rightarrow C$ is found to be rate $=k[A][B]$.The correct statement in relation to this reaction is that the **(AIEEE 2004)**
(a) unit of k must be s^{-1}
(b) t$_{1/2}$ is a constant
(c) rate of formation of C is twice the rate of disappearance of A
(d) value of k is independent of the initial concentrations of A and B

36. In a first order reaction, the concentration of the reactant, decreases from 0.8 M to 0.4 M in 15 min. The time taken for the concentration to change from 0.1 M to 0.025 M is **(AIEEE 2004)**
(a) 30 min (b) 15 min
(c) 7.5 min (d) 60 min

37. In a first order reaction the concentration of the reactant decreases from 800 mol/dm^3 to 50 mol/dm^3 in 2 × 10^{4}s. The rate constant of reaction in s^{-1} is **(IIT 2003)**
(a) 2 × 10^4 (b) 3.45 × 10^{-5}
(c) 1.386 × 10^{-4} (d) 2 × 10^{-4}

38. In respect of the equation $k=Ae^{-E_a/RT}$ in chemical kinetics, which one of the following statements is correct? **(AIEEE 2003)**

2022/ps/Chemical Kinetic

(a) k is equilibrium constant(b)A is adsorption factor

(c) E_a is energy of activation(d)R is Rydberg constant

39. 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 t he reaction will be as **(AIEEE 2003)**

(a) $\frac{1}{2^{m+n}}$ (b) $(m+n)$ (c) $(n-m)$ (d) $2^{(n-m)}$

40. For the reaction system, $2NO(g) + O_2(g) \longrightarrow 2NO_2(g)$ volume is suddenly reduced 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 **(AIEEE 2003)**
(a) diminish to one-fourth of its initial value
(b) diminish to one-eighth of its initial value
(c) increase to eight times of its initial value
(d) increase to four times of its initial value

41. Consider the chemical reaction,

$$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$$

The rate of this reaction can be expressed in terms of time derivatives of concentration of $N_2(g)$, $H_2(g)$ or $NH_3(g)$. Identify the correct relationship amongst the rate expressions. **(IIT 2002)**

(a) Rate $= \frac{d[\mathrm{N_2}]}{dt} = -\frac{1}{3}\frac{d[\mathrm{H_2}]}{dt} = \frac{1}{2}\frac{d[\mathrm{NH_3}]}{dt}$

(b) Rate $= \frac{d[\mathrm{N_2}]}{dt} = -3\frac{d[\mathrm{H_2}]}{dt} = 2\frac{d[\mathrm{NH_3}]}{dt}$

(c) Rate $= \frac{d[\mathrm{N_2}]}{dt} = \frac{1}{3}\frac{d[\mathrm{H_2}]}{dt} = \frac{1}{2}\frac{d[\mathrm{NH_3}]}{dt}$

(d) Rate $= \frac{d[\mathrm{N_2}]}{dt} = -\frac{d[\mathrm{H_2}]}{dt} = \frac{d[\mathrm{NH_3}]}{dt}$

42. For the reaction $H_2 + I_2 \longrightarrow 2HI$, the differential rate law is **(AIEEE 2002)**

(a) $-\frac{d[H_2]}{dt} = -\frac{d[I_2]}{dt} = 2\frac{d[HI]}{dt}$

(b) $-2\frac{d[H_2]}{dt} = -2\frac{d[I_2]}{dt} = \frac{d[HI]}{dt}$

(c) $-\frac{d[H_2]}{dt} = -\frac{d[I_2]}{dt} = \frac{d[HI]}{dt}$

(d) $-\frac{d[H_2]}{2dt} = -\frac{d[I_2]}{2dt} = \frac{d[HI]}{dt}$

43. For a reaction $A + 2B \longrightarrow C$, rate is given by $+\frac{d[C]}{dt} = k[A][B]$, hence the order of the reaction is **(AIEEE 2002)**

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

44. Rate constant, k of the first order r eaction when initial concentration (C_0) and concentration (C_t) at time t, is given by equation $kt = \log C_0 - \log C_t$. Graph is a straight line if we plot **(AIEEE 2002)**

(a) $t \, vs \log C_0$ (b) $t \, vs \log C_t$

(c) $t^{-1} vs \log C_t$ (d) $\log C_0 \; vs \; \log C_t$

45. Consider the following two reactions,

$$A \longrightarrow \text{Product}; \; -\frac{d[A]}{dt} = k_1[A]^0$$

$$B \longrightarrow \text{Product}; \; -\frac{d[B]}{dt} = k_2[B]$$

k_1 and k_2 are expressed in terms of molarity (mol L^{-1}) and time (s^{-1}) as **(AIEEE 2002)**

(a) $\mathrm{s^{-1}, Ms^{-1}L^{-1}}$ (b) $\mathrm{Ms^{-1}, Ms^{-1}}$

(c) $\mathrm{S^{-1}, M^{-1}s^{-1}}$ (d) $\mathrm{Ms^{-1}, s^{-1}}$

46. H_2 gas is adsorbed on the metal surface like tungesten. This follows.......order reaction. **(AIEEE 2002)**
(a) third (b) second
(c) zero (d) first

47. If I is the intensity of absorbed light and C is the concentration of AB for the photochemical process. $AB + h\upsilon \rightarrow AB^*$, the rate of formation of AB* is directly proportional to **(IIT 2001)**
(a) C (b) I
(c) I^2 (d) C . I

48. The rate constant for the reaction $2N_2O_5 \longrightarrow 4NO_2 + O_2$ is 3.0 × 10^{-5} s^{-1}. If the rate is 2.40 × 10^{-5} s^{-1}. If the rate is 2.40 × 10^{-5} mol L^{-1} s^{-1}, then the concentration of N_2O_5 (in mol L^{-1}) is **(IIT 2000)**
(a) 1.4 (b) 1.2
(c) 0.04 (d) 0.8

49. Which one of the following statements is not correct? **(NEET 2017)**
(a) Calalyst does not initiate any reaction
(b) The value of equilibrium constant is changed in the presence of a catalyst in the reaction equilibrium
(c) Enzymes catalyse mainly biochemical reaction
(d) Coenzymes increase the catalytic activity of enzyme

50. A first order reaction has a specific reaction rate of $10^{-2}s^{-1}$. How much time will it take for 20 g of the reactant to reduce to 5 g? **(NEET 2017)**
(a) 238.6 s (b) 138.6 s
(c) 346.5 s (d) 693.0 s

51. Mechanism of a hypothetical reaction $X_2 + Y_2 \longrightarrow 2XY$ is given below: **(NEET 2017)**

(i) $X_2 \rightleftharpoons X + X$ (fast)

(ii) $X + Y_2 \longrightarrow XY + Y$ (slow)

(iii) $X + Y \longrightarrow XY$ (fast)

The overall order of the reaction will be: **(NEET 2017)**
(a) 1 (b) 2
(c) 0 (d) 1.5

52. The rate of a first-order reaction is 0.04 mol $L^{-1}s^{-1}$ at 10 sec and 0.03 mol $L^{-1}s^{-1}$ at 20 sec after initiation of the reaction. The half-life period of the reaction is **(NEET 2016)**
(a) 34.1 s (b) 44.1 s
(c) 54.1 s (d) 24.1 s

53. The decomposition of phosphine (PH_3) on tungsten at low pressure is a first-order reaction. It is because the **(NEET 2016)**

(a) rate is proportional to the surface coverage
(b) rate is inversely proportional to the surface coverage
(c) rate is independent of the surface coverage
(d) rate of decomposition is very slow

54. When initial concentration of a reactant is doubled in a reaction. Its half-life period is not affected. The order of the reaction is **(AIPMT 2015)**
(a) zero (b) first
(c) second
(d) more than zero but less than first

55. The activation energy of a reaction can be determined from the slope of which of the following graphs? **(AIPMT 2015)**
(a) $\ln K \upsilon s T$ (b) $\frac{\ln K}{T} \upsilon s T$
(c) $\ln K \upsilon s \frac{1}{T}$ (d) $\frac{T}{\ln K} \upsilon s \frac{1}{T}$

56. The rate constant of the reaction $A \rightarrow B$ is 0.6 × 10^{-3} mole per second. If the concentration of A i s 5 M then concentration of B after 20 min is **(AIPMT 2015)**
(a) 1.08 M (b) 3.60 M
(c) 0.36 M (d) 0.72 M

57. What is the activation energy for a reaction if its rate doubles when the temperature is raised from 20^0C to 35^0C? (R = 8.314 J $mol^{-1}K^{-1}$) **(NEET 2013)**
(a) 342 kJ mol^{-1} (b) 269 kJ mol^{-1}
(c) 34.7 kJ mol^{-1} (d) 15.1 kJ mol^{-1}

58. In a reaction, $A + B \rightarrow$ Product, rate is doubled when the concentration of B is doubled and rate increases by a factor of B when the concentrations of both the reactants (A and B) are doubled. Rate law for the reaction can be written as **(AIPMT 2012)**
(a) rate $= k[A][B]^2$ (b) rate $= k[A]^2[B]^2$
(c) rate $= k[A]\ [B]$ (d) rate $= k[A]^2[B]$

59. In a zero order reaction for every 10^0C rise of temperature, the rate is doubled. If the temperature is increased from 10^0C to 100^0C, the rate of the reaction will become **(AIPMT 2012)**
(a) 256 times (b) 512 times
(c) 64 times (d) 128 times

60. Which one of the following statements for the order of a reaction is incorrect? **(AIPMT 2011)**
(a) Order is not influenced by stoichometric coefficient of the reactant is
(b) Order of reaction is sum of power to the concentration terms of reactants to express the rate of reaction
(c) Order of reaction is always whole number
(d) Order can be determined only experimentally

61. For the reaction,

$$N_2O_5(g) \longrightarrow 2NO_2(g) + \frac{1}{2}O_2(g)$$

The value of rate of disappearance of N_2O_5 is given as 6.25 × 10^{-3} mol $L^{-1}s^{-1}$. The rate of formation of NO_2 and O_2 is given respectively as **(AIPMT 2010)**
(a) 6.25×10^{-3} mol $L^{-1}s^{-1}$ and 6.25×10^{-3} mol $L^{-1}s^{-1}$
(b) 1.25×10^{-3} mol $L^{-1}s^{-1}$ and 3.125×10^{-3} mol $L^{-1}s^{-1}$
(c) 6.25×10^{-3} mol $L^{-1}s^{-1}$ and 3.125×10^{-3} mol $L^{-1}s^{-1}$
(d) 1.25×10^{-3} mol $L^{-1}s^{-1}$ and 6.25×10^{-3} mol $L^{-1}s^{-1}$

62. For an endothermic reaction, energy of activation is E_0 and enthalpy of reaction is ΔH (both of these in kJ/mol). Minimum value of E_a will be **(AIPMT 2010)**
(a) less than ΔH (b) equal to ΔH
(c) more than ΔH (d) equal to zero

63. During the kinetic study of the reaction, $2A + B \longrightarrow C + D$, following results were obtained

Run	**A/mol L⁻¹**	**B/mol L⁻¹**	**Initial rate of formation of D/mol L⁻¹min⁻¹**
I	0.1	0.1	6.0×10^{-3}
II	0.3	0.2	7.2×10^{-2}
III	0.3	0.4	2.88×10^{-1}
IV	0.4	0.1	2.40×10^{-2}

Based on the above data which one of the following is correct? **(AIPMT 2010)**
(a) rate $= k[A]^2[B]$ (b) rate $= k[A][B]$
(c) rate $= k[A]^2[B]^2$ (d) rate $= k[A][B]^2$

64. In the reaction, $BrO_3^-(aq) + 5Br^-(aq) + 6H^+ \longrightarrow 3Br_2(l) + 3H_2O(l)$ the rate of appearance of bromine (Br_2) is related to rate of disapperance of bromide ions as following. **(AIPMT 2009, 2008)**
(a) $\frac{d[Br_2]}{dt} = -\frac{3}{5}\frac{d[Br^-]}{dt}$ (b) $\frac{d[Br_2]}{dt} = -\frac{5}{3}\frac{d[Br^-]}{dt}$
(c) $\frac{d[Br_2]}{dt} = \frac{5}{3}\frac{d[Br^-]}{dt}$ (d) $\frac{d[Br_2]}{dt} = \frac{3}{5}\frac{d[Br^-]}{dt}$

65. For the reaction, $N_2 + 3H_2 \longrightarrow 2NH_3$, if $\frac{d[NH_3]}{dt} = 2 \times 10^{-4}$ mol L^{-1} s^{-1}, the value of $\frac{-d[H_2]}{dt}$ would be **(AIPMT 2009)**
(a) 3×10^{-4} mol $L^{-1}s^{-1}$ (b) 4×10^{-4} mol $L^{-1}s^{-1}$
(c) 6×10^{-4} mol $L^{-1}s^{-1}$ (d) 1×10^{-4} mol $L^{-1}s^{-1}$

66. For the reaction, $A + B \longrightarrow$ products, it is observed that
I. On doubling the initial concentration of A only, the rate of reaction is also doubled and
II. On doublinhg the initial concentrations of both A and B, there is a change by a factor of 8 in the rate of the reaction.
The rate of this reaction is given by **(AIPMT 2009)**
(a) rate $= k[A]^2[B]$ (b) rate $= k[A][B]^2$
(c) rate $= k[A]^2[B]^2$ (d) rate $= k[A]\ [B]$

67. Half-life period of a first order reaction is 1.386s. The specific rate constant of the reaction is: **(AIPMT 2009)**
(a) $5.0\times10^{-3}\,s^{-1}$ (b) $0.5\times10^{-2}\,s^{-1}$
(c) $0.5\times10^{-3}\,s^{-1}$ (d) $0.5\times10^{-2}\,s^{-1}$

68. The rate constants 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 **(AIMPT 2008)**
(a) 1000 K (b) $\frac{2000}{2.303}K$
(c) 2000 K (d) $\frac{1000}{2.303}K$

69. The bromination of acetone that occurs in acid solution is represented by this equation $CH_3COCH_3(aq) \longrightarrow CH_3COCH_2Br(aq) + H^+(aq) + Br^-(aq)$
These kinetic data were obtained for given reaction concentrations.

Initial concentration, *M*

$[CH_3COCH_3]$	**$[Br_2]$**	**$[H^+]$**
0.30	0.05	0.05
0.30	0.10	0.05
0.30	0.10	0.10
0.40	0.05	0.20

Initial rate, disappearance of Br_2, Ms^{-1}
5.7×10^{-5} 5.7×10^{-5}
1.2×10^{-4} 3.1×10^{-4}
Based on these data, the rate equation is **(AIPMT 2008)**
(a) rate $= k[CH_3COCH_3][H^+]$
(b) rate $= k[CH_2 = COCH_3][Br_2]$
(c) rate $= k[CH_3COCH_3][Br_2][H^+]^2$
(d) rate $= k[CH_3COCH_3][Br_2][H^+]$

70. The reaction of hydrogen and iodine monochloride is given as $H_2(g) + 2ICl(g) \longrightarrow 2HCl(g) + I_2(g)$
This reaction is of first order with respect to H_2(g) and ICl(g), following mechanisms were proposed
Mechanism A
$H_2(g) + 2ICl(g) \longrightarrow 2HCl(g) + I_2(g)$
Mechanism B
$H_2(g) + ICl(g) \longrightarrow HCl(g) + HI(g)$, slow
$HI(g) + ICl(g) \longrightarrow HCl(g) + I_2(g)$, fast
Which of the above mechanism(s) can be consistent with the given information about the reaction? **(AIPMT 2007)**
(a) Only B (b) Both A and B
(c) Neither A nor B (d) Only A

71. If 60% of a first order reaction was completed in 60 min, 50% of the same reaction would be completed in approximately (log 4 = 0.60, log 5 = 0.69) **(AIPMT 2007)**
(a) 50 min (b) 45 min
(c) 60 min (d) 40 min

72. In a first order reaction, $A \longrightarrow B$, if k is rate constant and initial concentration of the reactant A is 0.5 M, then the half-life is **(AIPMT 2007)**
(a) $\frac{0.693}{0.5k}$ (b) $\frac{\log 2}{k}$
(c) $\frac{\log 2}{k\sqrt{0.5}}$ (d) $\frac{\ln 2}{k}$

73. Consider the reaction, $N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$
The equality relationship between $\frac{d[NH_3]}{dt}$ and $-\frac{d[H_2]}{dt}$ is **(AIPMT 2006)**
(a) $\frac{d[NH_3]}{dt} = -\frac{1}{3}\frac{d[H_2]}{dt}$ (b) $+\frac{d[NH_3]}{dt} = -\frac{2}{3}\frac{d[H_2]}{dt}$
(c) $+\frac{d[NH_3]}{dt} = -\frac{3}{2}\frac{d[H_2]}{dt}$ (d) $\frac{d[NH_3]}{dt} = -\frac{d[H_2]}{dt}$

74. For the reaction, $2A + B \longrightarrow 3C + D$
which of the following does not express the reaction rate? **(AIPMT 2006)**
(a) $-\frac{d[C]}{3dt}$ (b) $-\frac{d[B]}{dt}$
(c) $\frac{d[D]}{dt}$ (d) $-\frac{d[A]}{2dt}$

75. The rate of reaction between two reactants A and B decreases by a factor of 4, if the concentration of reactant B is doubled. The order of this reaction with respect to reactant B is **(AIPMT 2005)**
(a) -1 (b) - 2
(c) 1 (d) 2

76. For a first order reaction, $A \longrightarrow B$, the reaction rate at reactant concentration of 0.01 M is found to be 2.0×10^{-5} mol $L^{-1}s^{-1}$. The half-life period of the reaction is **(AIPMT 2005)**
(a) 220 s (b) 30 s
(c) 300 s (d) 347 s

77. The rate of first order reaction is 1.5×10^{-2} mol L^{-1} at 0.5 M concentration of the reactant. The half-life of the reaction is **(AIPMT 2004)**
(a) 0.383 min (b) 23.1 min
(c) 8.73 min (d) 7.53 min

78. The activation energy for a simple chemical reaction, A $\longrightarrow$ B is E_a in forward direction. The activation energy for reverse reaction **(AIPMT 2003)**
(a) can be less than or more than E_a
(b) is always double of E_a
(c) is negative of E_a
(d) is always less than E_a

79. If the rate of a reaction is equal to the rate constant, the order of the reaction is **(AIPMT 2003)**
(a) 2 (b) 3
(c) 0 (d) 1

80. The temperature dependence of rate constant (k) of a chemical reaction is written in terms of Arrhenius equation, $k = Ae^{-E^*/RT}$. Activation energy (E*) of the reaction can be calculated by plotting **(AIPMT 2003)**

(a) $\log k\, vs \frac{1}{T}$ (b) $\log k\, vs \frac{1}{\log T}$

(c) $k\, vs\, T$ (d) $k\, vs \frac{1}{\log T}$

81. The reaction, $A \rightarrow B$ follows first order kinetics. The time taken for 0.8 mole of A to produce 0.6 mole of B is 1h. What is the time taken for the conversion of 0.9 mole of A to 0.675 mole of B? **(AIPMT 2003)**

(a) 0.25 h (b) 2 h

(c) 1 h (d) 0.5 h

82. $3A \longrightarrow B + C$ it would be a zero order reaction. When **(AIPMT 2002)**

(a) the rate of reaction is proportional to square of concentration of A
(b) the rate of reaction remains same at any concentration of A
(c) the rate remains unchanged at any concentration of B and C
(d) the rate of reaction doubles if concentration of B is increased to double

83. $3A \longrightarrow 2B$, rate of reaction $+\frac{d[B]}{dt}$ is equal to **(AIPMT 2002)**

(a) $-\frac{3}{2}\frac{d[A]}{dt}$ (b) $-\frac{2}{3}\frac{d[A]}{dt}$

(c) $-\frac{1}{3}\frac{d[A]}{dt}$ (d) $+2\frac{d[A]}{dt}$

84. When a biochemical reaction is carried out in laboratory from outside of human body in the absence of enzyme, the rate of reaction botained is 10^{-6} times, then activation energy of the reaction in the presence of enzyme is **(AIPMT 2001)**

(a) $\frac{6}{RT}$
(b) P is required
(c) different from E_a obtained in laboratory
(d) cannot say any things

85. For the reaction, $2N_2O_5 \longrightarrow 4NO_2 + O_2$, rate and rate constant are 1.02×10^{-4} and 3.4×10^{-5} s^{-1} respectively, then concentration of N_2O_5 at that time will be **(AIPMT 2001)**

(a) 1.732 (b) 3

(c) 1.02×10^{-4} (d) 3.4×10^{5}

86. For a first-order reaction, the half-life period is independent of **(AIPMT 1999)**

(a) initial concentration
(b) cube root of initial concentration
(c) first power of final concentration
(d) square root of final concentration

87. Activation energy of a chemical reaction can be determined by **(AIPMT 1998)**

(a) evaluating rate constant at standard temperature
(b) evaluating velocities of reaction at two different temperatures
(c) evaluating rate constants at two different temperatures
(d) changing concentration of reactants

88. The experimental data for the reaction $2A + B_2 \longrightarrow 2AB$ is

Exp.	[A]	$[B_2]$	Rate (M s^{-1})
1.	0.50	0.50	1.6×10^{-4}
2.	0.50	1.00	3.2×10^{-4}
3.	1.00	1.00	3.2×10^{-4}

The rate equation for the above data is **(AIPMT 1997)**

(a) rate $= k[B_2]$ (b) rate $= k[B_2]^2$

(c) rate $= k[A]^2[B]^2$ (d) rate $= k[A]^2[B]$

89. In a reversible reaction, the energy of activation of the forward reaction is 50 kcal. The energy of activation for the reverse reaction will be **(AIPMT 1996)**

(a) < 50 kcal
(b) 50 kcal
(c) either greater than or less than 50 kcal
(d) > 50 kcal

90. The plot of concentration of the reactant versus time for a reaction is a straight line with a negative slope. **(AiPMT 1996)**

(a) zero order rate equation
(b) first order rate equation
(c) second order rate equation
(d) third order rate eqation

91. A substance A decomposes by a first order reaction starting initially with [A] = 2.00 m and after 200 min. [A] becomes 0.15 m. For this reaction $t_{1/2}$ is **(AIPMT 1995)**

(a) 53.49 min (b) 50.49 min

(c) 48.45 min (d) 46.45 min

92. A chemical reaction is catalysed by a catalyst X. Hence, X **(AIPMT 1995)**

(a) reduces enthalpy of the reaction
(b) decreases rate constant of the reaction
(c) increases activation energy of the reaction
(d) does not affect equilibrium constant of the reaction

93. For exothermic reaction, the energy of activation of the reactant is **(AIPMT 1994)**

(a) equal to the energy of activation of products
(b) less than the energy of activation of products
(c) greater than the energy of activation of products
(d) sometimes greater and sometimes less than that of the products.

94. The correct difference between first and second order is that **(NEET 1994)**

(a) a first order reaction can be catalysed, a second order reaction cannot be catalysed
(b) the half life of a first order reaction does not depend on $[A]_0$, the half life of a second order reaction does depend on $[A]_0$
(c) the rate of a first order reaction does not depend

on reactant concentrations the rate of a second order reaction does depend on reactant cocentrations.

(d) the rate of first order reaction does depend on reactant concentrations, the rate of a second order reaction does not depend on reactant concentrations

95. When intial concentration of the reaction is doubled the half life period of a zero order reaction

(a) is tripled
(b) is doubled
(c) is halved
(d) remains unchanged

(NEET 1994)

96. The results given in the below table were obtained during kinetic studies of the following reaction:

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

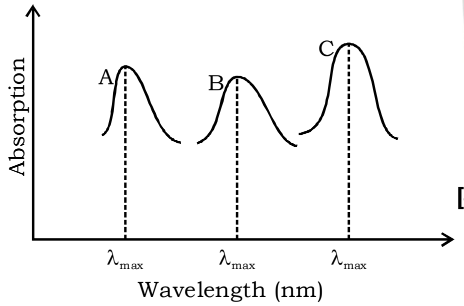
Experiment	**[*A*]mol L^{-1}**	**[B]/mol L^{-1}**	**Initial rate/ mol L^{-1} min^{-1}**
I	0.1	0.1	600×10^{-3}
II	0.1	0.2	2.40×10^{-2}
III	0.2	0.1	120×10^{-2}
IV	X	0.2	720×10^{-2}
V	0.3	Y	2.88×10^{-1}

X and Y in the given table are respectively.

[JEE Main 2020]

(a) 0.4, 0.4
(b) 0.4, 0.3
(c) 0.3, 0.4
(d) 0.3, 0.3

97. Simplified absorption spectra of three complexes [(i), (ii) and (iii)] of M^{n+} ion are provided below; their λ_{max} values are marked as *A, B* and *C* respectively. The correct match between the complexes and their λ_{max} values is



[JEE Main 2020]

(i) $[M(NCS)_6]^{(-6+n)}$
(ii) $[MF_6]^{(-6+n)}$
(iii) $[M(NH_3)_6]^{n+}$

(a) A-(iii), B-(i), C-(ii)
(b) A-(ii), B-(i), C-(iii)
(c) A-(ii), B-(iii), C-(i)
(d) A-(i), B-(ii), C-(iii)

98. Amongst the following statements regarding adsorption, those that are valid are:**[JEE Main 2020]**

(A) ΔH becomes less negative as adsorption proceeds.
(B) On a given adsorbent, ammonia is adsorbed more than nitrogen gas.
(C) On adsorption, the residual force acting along the surface of the adsorbent increases.
(D) With increase in temperature, the equilibrium concentration of adsorbate increases.

(a) (D) and (A)
(b) (B) and (C)
(c) (A) and (B)
(d) (C) and (D)

99. It is true that **[JEE Main 2020]**

(a) a second order reaction is always a multistep reaction
(b) a zero order reaction is a multistep reaction
(c) a first order reaction is always a single step reaction
(d) a zero order reaction is a single step reaction

100. For the reaction $2A+3B+\frac{3}{2}C \rightarrow 3P$, which statement is correct? **[JEE Main 2020]**

(a) $\frac{dn_A}{dt}=\frac{2}{3}\frac{dn_B}{dt}=\frac{3}{4}\frac{dn_C}{dt}$
(b) $\frac{dn_A}{dt}=\frac{3}{2}\frac{dn_B}{dt}=\frac{3}{4}\frac{dn_C}{dt}$
(c) $\frac{dn_A}{dt}=\frac{dn_B}{dt}=\frac{dn_C}{dt}$
(d) $\frac{dn_A}{dt}=\frac{2}{3}\frac{dn_B}{dt}=\frac{4}{3}\frac{dn_C}{dt}$

101. If 75% of a first order reaction was completed in 90 minutes, 60% of the same reaction would be completed in approximately (in minutes) ....
(Take : log 2 = 0.30; log2.5 = 0.40) **[JEE Main 2020]**

(a) 20
(b) 30
(c) 40
(d) 60

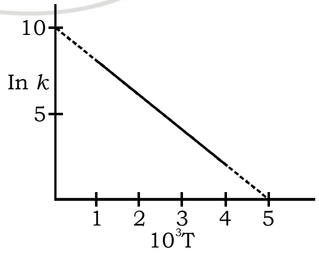
102. A flask contains a mixture of compounds *A* and *B*. Both compounds decompose by first-order kinetics. The half-life for *A* and *B* are 300s and 180s, respectively. If the concentrations of *A* and *B* are equal initially, the time required for the concentration of *A* to be four times that of *B* (in s) (Use ln 2 = 0.693) **[JEE Main 2020]**

(a) 120
(b) 180
(c) 300
(d) 900

103. Kraft temperature is the temperature**[JEE Main 2020]**

(a) below which the aqueous solution of detergents starts freezing
(b) below which the formation of micelles takes place
(c) above which the aqueous solution of detergents starts boiling
(d) above which the formation of micelles takes place

104. The rate constant (*k*) of a reaction is measured at different temperature (*T*), and the data are plotted in the given figure. The activation energy of the reaction in kJ mol^{-1} is (*R* is gas constant)



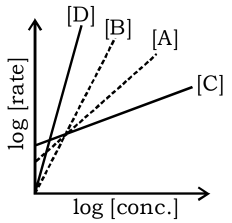
[JEE Main 2020]

(a) $\frac{2}{R}$
(b) $\frac{1}{R}$
(c) R
(d) $2R$

105. Consider the following reactions

$$A \rightarrow P1; B \rightarrow P2; C \rightarrow P3; D \rightarrow P4,$$

The order of the above reactions are *a, b, c* and *d*, respectively. The following graph is obtained when log[rate] vs log[conc.] are plotted:



Among the following, the correct sequence for the order of the reactions is **[JEE Main 2020]**

(a) D > A > B > C (b) A > B > C > D
(c) C > A > B > D (d) D > B > A > C

106.The rate of a reaction decreased by 3.555 times when the temperature was changed from 40^{0}C to 30^{0}C. The activation energy (in kJ mol^{-1}) of the reaction is .... (Take; R = 8.314 J mol^{-1}K^{-1}, ln 3.555 = 1.268)

(a) 50 (b) 100
(c) 80 (d) 160**[JEE Main 2020]**

107.For the reaction

$2H_2(g)+2NO(g) \rightarrow N_2(g)+2H_2O(g)$

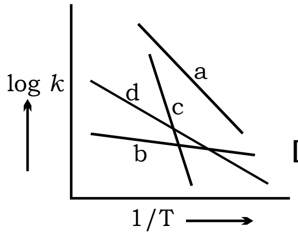
the observed rate expression is, rate $= k_f[NO]^2[H_2]$. The rate expression for the reverse reaction is **[JEE Main 2020]**

(a) $k_b[N_2][H_2O]^2/[H_2]$ (b) $k_b[N_2][H_2O]$
(c) $k_b[N_2][H_2O]^2/[NO]$ (d) $k_b[N_2][H_2O]^2$

108.The rate of a certain biochemical reaction at physiological temperature (*T*) occurs 10^6 times faster with enzyme than without. The change in the activation energy upon adding enzyme is: **[JEE Main 2020]**

(a) $+6RT$ (b) $-6(2.303)RT$
(c) $+6(2.303)RT$ (d) $-6RT$

109.Consider the following plots of rate constant *versus* $\frac{1}{T}$ for four different reactions. Which of the following orders s correct for the activation energies of these reactions?



[JEE Main 2020]

(a) $E_b > E_a > E_d > E_c$ (b) $E_a > E_c > E_d > E_b$
(c) $E_b > E_d > E_c > E_a$ (d) $E_c > E_a > E_d > E_b$

110.For the following assertion and reacon the correct option is

Assertion For hydrogenation reactons, the catalytic activity increases from Group 5 to Group 11 metals with maximum activity shown by Group 7-9 elements.

Reason The reactants are most strongly adsorbed on group 7-9 elements. **[JEE Main 2020]**

(a) The Assertion is true, but the Reason is false.
(b) Both Assertion and Reason are true, but the Reason is not the correct explanation for the Assertion.
(c) Both Assertion and Reason are true and the Reason is the correct explanation for the Assertion.
(d) Both Assertion and REason are false.

111.For following reactions:

$A \xrightarrow{700K}$ Product; $A \xrightarrow[\text{Catalyst}]{500K}$ Product

It was found that E_a is decreased by 30 kJ/mol in the presence of catalyst. If the rate remains unchanged, the activation energy for catalysed reaction is (Assume pre exponential factor is same): **[JEE Main 2020]**

(a) 198 kJ/mol (b) 105 kJ/mol
(c) 75 kJ/mol (d) 135 kJ/mol

112.A sample of milk splits after 60 min. at 300 K and after 40 min. at 400 K when the propulation of *lactobacillus acidophilus* in it doubles. The activation energy (in kJ/mol) for this process is closet to **[JEE Main 2020]**

(Given, $R = 8.3$ J mol^{-1}K^{-1} $\ln\left(\frac{2}{3}\right) = 0.4$, $e^{-3} = 4.0$)

(a) 3 (b) 3.5
(c) 3.98 (d) 4.20

113.For the reaction, $2A + B \rightarrow C$, the values of initial rate at different reactant concentrations are given in the table below. The rate law for the reaction is

[A] (mol L^{-1})	**[B]** (mol L^{-1})	**Initial rate** (mol L^{-1}s^{-1})
0.05	0.05	0.045
0.10	0.05	0.090
0.20	0.10	0.72

[JEE Main 2020]

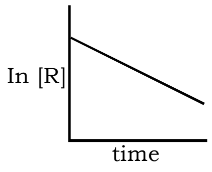
(a) rate $= k[A][B]^2$ (b) rate $= k[A]^2[B]^2$
(c) rate $= k[A][B]$ (d) rate $= k[A]^2[B]$

114.For a reaction scheme, $A \xrightarrow{k_1} B \xrightarrow{k_2} C$, if the rate of formation of *B* is set to be zero then the concentration of *B* is given by **[JEE Main 2020]**

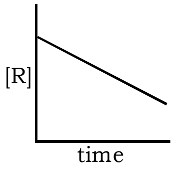
(a) $k_1k_2[A]$ (b) $\left(\frac{k_1}{k_2}\right)[A]$
(c) $(k_1 - k_2)[A]$ (d) $(k_1 + k_2)[A]$

115.The given plots represent the variation of the concentration of a reaction *R* with time for two different reactions (i) and (ii). The respective orders of the reactions are

(i)



(ii)



[JEE Main 2020]

(a) 1, 1 (b) 0, 2
(c) 0, 1 (d) 1, 0

116.Match the catalysts Column I with products Column II. **[JEE Main 2020]**

Column I		**Column II**
	(Catalyst)	(Product)
(A)	V_2O_5	(i) Polyethlyene
(B)	$TiCl_4/Al(Me)_3$	(ii) Ethanal
(C)	$PbCl_2$	(iii) H_2SO_4
(D)	Iron oxide	(iv) NH_3

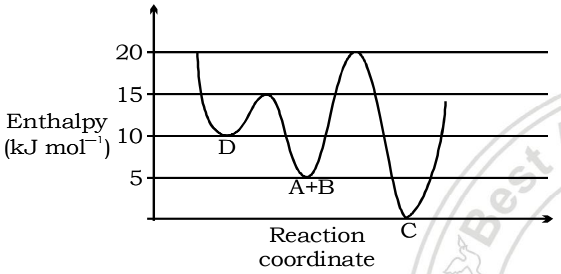
(a) (A)-(ii), (B)-(iii), (C)-(i), (D)-(iv)
(b) (A)-(iv), (B)-(iii), (C)-(ii), (D)-(i)
(c) (A)-(iii), (B)-(i), (C)-(ii), (D)-(iv)
(d) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)

117.For the reaction of H_2 with I_2, the rate constant is 2.5 × 10^{-4} $_{dm}{}^{3}$ $mol^{-1}s^{-1}$ at 327^{0}C and 1.0 $dm^3mol^{-1}s^{-1}$ at 527^{0}C. The activation energy for the reaction, in kJ mol^{-1} is (R = 8.314 $JK^{-1}mol^{-1}$) **[JEE Main 2020]**

(a) 59 (b) 72
(c) 150 (d) 166

118.Consider the given plot of enthalpy of the following reaction between *A* and *B*. $A + B \longrightarrow C + D$

Identify the incorrect statement. **[JEE Main 2020]**



(a) *D* is kinetically stable product.
(b) Formation of *A* and *B* from *C* has highest enthalpy of activation.
(c) *C* is the thermodynamically stable product.
(d) Activation enthalpy to from *C* is 5 kJ mol^{-1} less than that to from *D*.

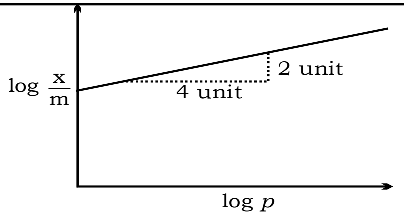
119.The correct option among the following is **[JEE Main 2019]**

(a) colloidal medicines are more effective, because they have small surface area.
(b) brownian motion in colloidal solution is faster if the viscosity of the solution is very high.
(c) addition of alum to water makes it unfit for drinking.
(d) colloidal particles in lyophobic sols can be precipitated by electrophoresis.

120.Among the following, the incorrect statement about colloids is **[JEE Main 2019]**

(a) They can scatter light
(b) They are larger than small molecules and have high molar mass
(c) The osmotic pressure of a colloidal solution is of higher order than the true solution at the same concentration
(d) The range of diameters of colloidal particles is between 1 and 1000 nm

121.Adsorption of a gas follows Freundlich adsorption isotherm. In the given plot, *x* is the mass of the gas adsorbed on mass *m* of the adsorbent at pressure $p.(x/m)$ is proportional to



[JEE Main 2019]

(a) $p^{2/3}$ (b) $p^{1/4}$
(c) $p^{1/2}$ (d) p

ANSWER

1. (b)	2. (c)	3. (a)	4. (a, d)	5. (a,c)
6. (d)	7. (b, c, d)	8. (a)	9. (a)	10. (b)
11. (d)	12. (d)	13. (a)	14. (b)	15. (a,b,d)
16. (c)	17. (b)	18. (c)	19. (a)	20. (d)
21. (c)	22. (b)	23. (a)	24. (d)	25. (a)
26. (d)	27. (d)	28. (d)	29. (b)	30. (c)
31. (d)	32. (d)	33. (c)	34. (a)	35. (d)
36. (a)	37. (c)	38. (c)	39. (d)	40. (c)
41. (a)	42. (b)	43. (b)	44. (b)	45. (d)
46. (c)	47. (b)	48. (d)	49 (b)	50. (b)
51. (d)	52. (d)	53. (a)	54. (b)	55. (c)
56. (d)	57. (c)	58. (d)	59. (b)	60. (c)
61. (b)	62. (c)	63. (d)	64. (a)	65. (a)
66. (b)	67. (c)	68. (d)	69. (a)	70. (a)
71. (b)	72. (d)	73. (b)	74. (a)	75. (b)
76. (d)	77. (b)	78. (a)	79. (c)	80. (a)
81. (c)	82. (b)	83. (b)	84. (c)	85. (b)
86. (a)	87. (c)	88. (a)	89. (c)	90. (b)
91. (a)	92. (d)	93. (b)	94. (b)	95. (b)
96. (c)	97. (a)	98. (c)	99. (b)	100.(d)
101.(d)	102.(d)	103.(d)	104.(d)	105.(d)
106.(b)	107.(a)	108.(b)	109.(d)	110.(a)
111.(c)	112.(c)	113.(a)	114.(b)	115.(d)
116.(c)	117.(d)	118.(d)	119.(d)	120.(c)
121.(a)				