Date Planned : __ / __ / __	Daily Tutorial Sheet-3	Expected Duration : 90 Min
Actual Date of Attempt : __ / __ / __	JEE Advanced (Archive)	Exact Duration :_________

31. The vapour pressure of the two miscible liquids (A) and (B) are 300 and 500 mm of Hg respectively. In a flask 10 moles of (A) is mixed with 12 moles of (B). However, as soon as (B) is added, (A) starts polymerizing into a completely insoluble solid. The polymerization follows first-order kinetics. After 100 min, 0.525 mole of a solute is dissolved which arrests the polymerization completely. The final vapour pressure of the solution is 400 mm of Hg. Estimate the rate of constant of the polymerization completely. The final vapour pressure of the solution is 400 mm of Hg. Estimate the rate of constant of the polymerization completely. Assume negligible volume change on mixing and polymerization and ideal behaviour for the final solution. **(2001)**

32. The rate of a first-order reaction is 0.04 mol litre^{-1} s^{-1} at 10 min and 0.03 mol litre^{-1} s^{-1} at 20 min after initiation. Find the half-life of the reaction. **(2001)**

33. For the given reaction, $A + B \longrightarrow$ Products **(2004)**

Following data are given

Initial conc. (m/L) $[A]_0$	**Initial conc.** (m/L) $[B]_0$	**Initial rate** $[mL^{-1}s^{-1}]$
0.1	0.1	0.05
0.2	0.1	0.1
0.1	0.2	0.05

(a) Write the rate equation

(b) Calculate the rate constant

34. $2X(g) \longrightarrow 3Y(g) + 2Z(g)$ **(2005)**

Time (in min)	0	100	200
Partial pressure of X (in mmg Hg)	800	400	200

Assuming ideal gas condition. Calculate :

(a) order of reaction

(b) rate constant

(c) time taken for 75% completion of reaction

(d) total pressure when p_x = 700 mm

35. $Ag^+ + NH_3 \rightleftharpoons [Ag(NH_3)]^+; k_1 = 6.8 \times 10^{-3}$ **(2006)**

$[Ag(NH_3)]^+ + NH_3 \rightleftharpoons [Ag(NH_3)_2]^+$ is : $k_2 = 1.6 \times 10^{-3}$

(A) 6.8×10^{-6} **(B)** 1.08×10^{-5} **(C)** 1.08×10^{-6} **(D)** 6.8×10^{-5}

36. Consider a reaction, $aG + bH \longrightarrow$ 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 becomes four ions. The overall order of the reaction is: **(2007)**

(A) 0 **(B)** 1 **(C)** 2 **(D)** 3

37. Under the same reaction conditions, initial concentration of 1.386 mol dm^{-3} of a substance becomes half in 40 seconds and 20 seconds through first order and zero order kinetics, respectively. Ratio $\left(\frac{k_1}{k_0}\right)$ of the rate constants for first order (k_1) and zero order (k_0) of the reactions is **(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

38. For a first order reaction $A \rightarrow P$, the temperature (T) dependent rate constant (k) was found to follow the equation $\log k = -(2000)\frac{1}{T} + 6.0$. The pre-exponential factor A and the activation energy E_a, respectively, are : **(2009)**

(A) $1.6 \times 10^6 s^{-1}$ 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 $38.3\,kJ\,mol^{-1}$

39. The concentration of R in the reaction $R \longrightarrow P$ was measured as a function of time and the following data is obtained : **(2010)**

[R] (molar)	1.0	0.75	0.40	0.10
t(min)	0.0	0.05	0.12	0.18

The order of the reaction is _______.

***40.** For the first order reaction : $2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$ **(2011)**

(A) the concentration of the reactant decrease 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

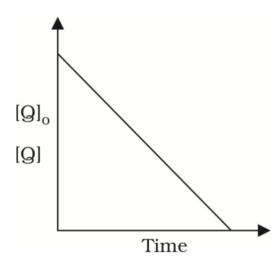
(D) the reaction proceeds to 99.6 % completion in eight half-life duration

41. An organic compound undergoes first order decomposition. The time taken for its decomposition to 1/8 and 1/10 of its initial concentration are $t_{1/8}$ and $t_{1/10}$ respectively. What is the value $\frac{[t_{1/8}]}{[t_{1/10}]} \times 10$? ($\log_{10} 2 = 0.3$)? **(2012)**

42. In the reaction, **(2013)**

$P + Q \longrightarrow R + S$

the time taken for 75% reaction of P is twice the time taken 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 :



(A) 2 **(B)** 3
(C) 0 **(D)** 1

43. For the elementary reaction, $M \longrightarrow N$, 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: **(2014)**

(A) 4 **(B)** 3

(C) 2 **(D)** 1

44. A closed vessel with rigid walls contains 1 mol of ${}^{238}_{92}U$ and 1 mol of air at 298 K. Considering complete decay of ${}^{238}_{92}U$ to ${}^{206}_{82}Pb$, the ratio of the final pressure to the initial pressure of the system at 298 K is __________. **(2015)**

45. According to the Arrhenius equation, **(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

46. A plot of the number of neutrons (N) against the number of protons (P) of stable nuclei exhibits upward deviation from linearity for atomic number, $Z > 20$. For an unstable nucleus having N/P ratio less than 1, the possible mode(s) of decay is(are) : **(2016)**

(A) $\beta^- - \text{decay}(\beta\,\text{emission})$

(B) orbital or K-electron capture

(C) neutron emission

(D) $\beta^+ - \text{decay}(\text{positron emission})$

47. In a bimolecular reaction, the steric factor P was experimentally determined to be 4.5. The correct option(s) among the following is(are) **(2017)**

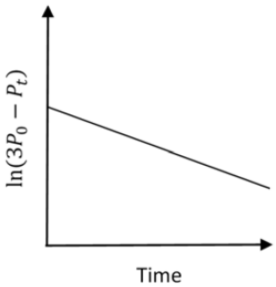
(A) Experimentally determined value of frequency factor is higher than that predicted by Arrhenius equation

(B) The value of frequency factor predicted by Arrhenius equation is higher than that determined experimentally

(C) The activation energy of the reaction is unaffected by the value of the steric factor

(D) Since $P = 4.5$, the reaction will not proceed unless an effective catalyst is used

48. 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_t, 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 $1/3^{rd}$ of its initial value. The correct option(s) is(are) : **(2018)**

(A)


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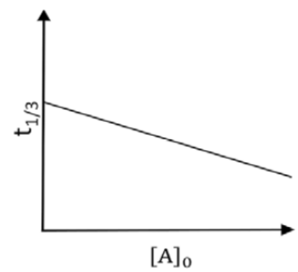

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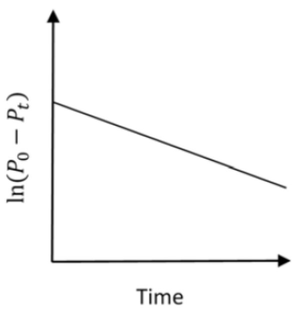

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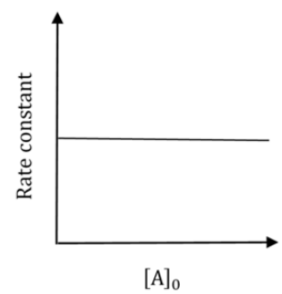
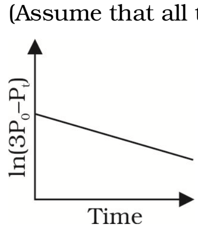
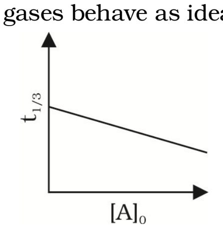


49. For a first order reaction $A(g) \rightarrow 2B(g) + C(g)$ at constant volume and 300 K, the total pressure at the beginning (t – 0) and at time t are P_0 and P_t, respectively. Initially, only A is present with concentration $[A]_0$, and $t_{1/3}$ is the time required for the partial pressure of A to reach $1/3^{rd}$ of its initial value. The correct option(s) is (are) **(2018)**

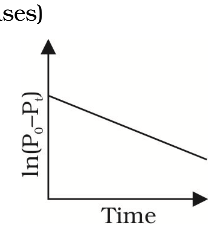
(Assume that all these gases behave as ideal gases)



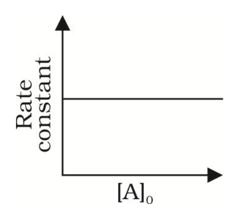
(A)



(B)



(C)



(D)

50. In the decay sequence, **(2019)**

$${}^{238}_{92}U \xrightarrow{-x_1} {}^{234}_{90}Th \xrightarrow{-x_2} {}^{234}_{91}Pa \xrightarrow{-x_3} {}^{234}Z \xrightarrow{-x_4} {}^{230}_{90}Th$$

x_1, x_2, x_3 and x_4 are particles/radiation emitted by the respective isotopes. The correct option(s) is(are):

(A) x_2 is β^-

(B) Z is an isotope of uranium

(C) x_3 is x-ray

(D) x_1 will deflect towards negatively charged plate

51. Consider the kinetic data given in the following table for the reaction $A + B + C \rightarrow$ Product. **(2019)**

Experiment No.	**[A] (mol dm^{-3})**	**[B] (mol dm^{-3})**	**[C] (mol dm^{-3})**	**Rate of reaction (mol dm^{-3} s^{-1})**
1	0.2	0.1	0.1	6.0×10^{-5}
2	0.2	0.2	0.1	6.0×10^{-5}
3	0.2	0.1	0.2	1.2×10^{-4}
4	0.3	0.1	0.1	9.0×10^{-5}

The rate of the reaction for [A] = 0.15 mol dm^{-3}, [B] = 0.25 mol dm^{-3}, and [C] = 0.15 mol dm^{-3}, is found to be $Y \times 10^{-5}$ mol dm^{-3} s^{-1}. The value of Y is _______ .

52. The decomposition reaction $2N_2O_5(g) \longrightarrow 2N_2O_4(g) + O_2(g)$ is started in a closed cylinder under isothermal isochoric condition at an initial pressure of 1 atm. After $Y \times 10^3$ s, the pressure inside the cylinder is found to be 1.45 atm. If the rate constant of the reaction is 5×10^{-4} s^{-1}, assuming ideal gas behavior, the value of Y is ____________. **(2019)**