PrepWiser.

CHEMISTRY · JEE MAIN

Chemical Kinetics

Chapter-wise previous year questions, with answer key

90	2020–2025	7
PYQS	PAPERS	TOPICS

Rate of Reaction · Rate Laws and Order · Arrhenius Equation · Mechanisms and Catalysis · Half-Life · Zero and First Order Reactions · Rate Law and Order

1. Attempt each question on paper first — they're grouped by topic, newest papers first.
2. Check yourself against the answer key at the end.
3. Got one wrong? Tap “Step-by-step solution” under it for the full working.

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Rate of Reaction · 9 PYQs

Q1 JEE Main 2024 · 30 Jan · Shift 2

NO_2 required for a reaction is produced by decomposition of N_2O_5 in CCl_4 as by equation

$$2N_2O_{5(g)} \rightarrow 4NO_{2(g)} + O_{2(g)}$$

The initial concentration of N_2O_5 is $3 mol L^{-1}$ and it is $2.75 mol L^{-1}$ after 30 minutes.
The rate of formation of NO_2 is $x \times 10^{-3} mol L^{-1} min^{-1}$, value of x is _____. (nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/GFuEuIIjmI

Q2 JEE Main 2023 · 11 Apr · Shift 1

$$KClO_3 + 6FeSO_4 + 3H_2SO_4 \rightarrow KCl + 3Fe_2(SO_4)_3 + 3H_2O$$

The above reaction was studied at $300 K$ by monitoring the concentration of $FeSO_4$ in which initial concentration was $10 M$ and after half an hour became 8.8 M. The rate of production of $Fe_2(SO_4)_3$ is _____ $\times 10^{-6} mol L s^{-1}$ (Nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/L7N1n0LHWE

Q3 JEE Main 2023 · 29 Jan · Shift 2

An indicator 'X' is used for studying the effect of variation in concentration of iodide on the rate of reaction of iodide ion with H_2O_2 at room temp. The indicator 'X' forms blue coloured complex with compound 'A' present in the solution. The indicator 'X' and compound 'A' respectively are :

(A) Methyl orange and H_2O_2
(B) Methyl orange and iodine
(C) Starch and H_2O_2
(D) Starch and iodine

Step-by-step solution ▸ prepwiser.in/questions/UDYaaQADvG

Q4 JEE Main 2023 · 24 Jan · Shift 2

A student has studied the decomposition of a gas AB_3 at 25°C. He obtained the following data.

p (mm Hg)	50	100	200	400
relative $t_{1/2}$ (s)	4	2	1	0.5

The order of the reaction is

(A) 2
(B) 0.5
(C) 1
(D) 0 (zero)

Step-by-step solution ▸ prepwiser.in/questions/f6rl_zg6-3

Q5 JEE Main 2022 · 28 Jul · Shift 1

For kinetic study of the reaction of iodide ion with H_2O_2 at room temperature :

(A) Always use freshly prepared starch solution.

(B) Always keep the concentration of sodium thiosulphate solution less than that of KI solution.

(C) Record the time immediately after the appearance of blue colour.

(D) Record the time immediately before the appearance of blue colour.

(E) Always keep the concentration of sodium thiosulphate solution more than that of KI solution.

Choose the correct answer from the options given below :

(A) $(A), (B), (C)$ only

(B) $(A), (D), (E)$ only

(C) $(D), (E)$ only

(D) $(A), (B), (E)$ only

Step-by-step solution ▸ prepwiser.in/questions/gVJpm9MAVq

Q6 JEE Main 2022 · 27 Jul · Shift 1

$$2NO + 2H_2 \rightarrow N_2 + 2H_2O$$

The above reaction has been studied at $800^\circ C$. The related data are given in the table below

Reaction serial number	Initial Pressure of H_2/kPa	Initial Pressure of NO/kPa	Initial rate $\left(\frac{-dp}{dt}\right)/(kPa/s)$
1	65.6	40.0	0.135
2	65.6	20.1	0.033
3	38.6	65.6	0.214
4	19.2	65.6	0.106

The order of the reaction with respect to NO is _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/uP0v22n9i_

Q7 JEE Main 2022 · 25 Jun · Shift 1

For a given chemical reaction

$\gamma_1 A + \gamma_2 B \rightarrow \gamma_3 C + \gamma_4 D$

Concentration of C changes from 10 mmol dm^{-3} to 20 mmol dm^{-3} in 10 seconds. Rate of appearance of D is 1.5 times the rate of disappearance of B which is twice the rate of disappearance A. The rate of appearance of D has been experimentally determined to be 9 mmol dm^{-3} s^{-1}. Therefore, the rate of reaction is _____ mmol dm^{-3} s^{-1}. (Nearest Integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/OAjUJ168XY

Q8 JEE Main 2021 · 27 Aug · Shift 1

The reaction that occurs in a breath analyser, a device used to determine the alcohol level in a person's blood stream is

$$2K_2Cr_2O_7 + 8H_2SO_4 + 3C_2H_6O \rightarrow 2Cr_2(SO_4)_3 + 3C_2H_4O_2 + 2K_2SO_4 + 11H_2O$$

If the rate of appearance of $Cr_2(SO_4)_3$ is 2.67 mol min^{-1} at a particular time, the rate of disappearance of C_2H_6O at the same time is _____ mol min^{-1}. (Nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/gRUsQVqs39

Q9 JEE Main 2021 · 25 Jul · Shift 2

For a chemical reaction A $\rightarrow$ B, it was found that concentration of B is increased by 0.2 mol L^{-} in 30 min. The average rate of the reaction is _____ $\times 10^{-1}$ mol L^{-1} h^{-1}. (in nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/jeqK_oj4aX

Rate Laws and Order · 5 PYQs

Q10 JEE Main 2025 · 4 Apr · Shift 1

Rate law for a reaction between A and B is given by

$\mathrm{r = k[A]^n[B]^m}$

If concentration of A is doubled and concentration of B is halved from their initial value, the ratio of new rate of reaction to the initial rate of reaction $\left(\frac{r_2}{r_1}\right)$ is

(A) $(\mathrm{n - m})$

(B) $2^{(\mathrm{n}-m)}$

(C) $\frac{1}{2^{m+n}}$

(D) $(\mathrm{m + n})$

Step-by-step solution ▸ prepwiser.in/questions/_zbDHwcFAg

Q11 JEE Main 2024 · 5 Apr · Shift 1

During Kinetic study of reaction $\mathrm{2A + B \rightarrow C + D}$, the following results were obtained :

	$\mathrm{A[M]}$	$\mathrm{B[M]}$	**initial rate of formation of** D
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 above data, overall order of the reaction is _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/zUta7Cklmz

Q12 JEE Main 2023 · 29 Jan · Shift 2

For conversion of compound A $\rightarrow$ B, the rate constant of the reaction was found to be $4.6 \times 10^{-5} \mathrm{Lmol}^{-1}\mathrm{s}^{-1}$. The order of the reaction is _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/tfwsxZUuBA

Q13 JEE Main 2022 · 29 Jul · Shift 1

The reaction between X and Y is first order with respect to X and zero order with respect to Y.

Experiment	$\frac{[X]}{mol\ L^{-1}}$	$\frac{[Y]}{mol\ L^{-1}}$	$\frac{Initial\ rate}{mol\ L^{-1}\ \mathrm{min}^{-1}}$
I	0.1	0.1	2×10^{-3}
I	L	0.2	4×10^{-3}
III	0.4	0.4	$M \times 10^{-3}$
IV	0.1	0.2	2×10^{-3}

Examine the data of table and calculate ratio of numerical values of M and L. (Nearest Integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/-kP15vJaOK

Q14 JEE Main 2020 · 7 Jan · Shift 2

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 :

(A) $K_b[N_2][H_2O]$

(B) $K_b[N_2][H_2O]^2/[H_2]$

(C) $K_b[N_2][H_2O]^2/[NO]$

(D) $K_b[N_2][H_2O]^2$

Step-by-step solution ▸ prepwiser.in/questions/JvY2b5deuP

Arrhenius Equation · 24 PYQs

Q15 JEE Main 2025 · 3 Apr · Shift 2

Consider the following statements related to temperature dependence of rate constants.

Identify the correct statements.

A. The Arrhenius equation holds true only for an elementary homogenous reaction.

B. The unit of A is same as that of k in Arrhenius equation.

C. At a given temperature, a low activation energy means a fast reaction.

D. A and Ea as used in Arrhenius equation depend on temperature.

E. When $\mathrm{Ea} \gg \mathrm{RT}$, A and Ea become interdependent.

Choose the correct answer from the options given below:

(A) A, C and D Only

(B) B, D and E Only

(C) B and C Only

(D) A and B Only

Step-by-step solution ▸ prepwiser.in/questions/MWGBGdsZLC

Q16 JEE Main 2025 · 24 Jan · Shift 2

Consider a complex reaction taking place in three steps with rate constants $\mathrm{k}_1, \mathrm{k}_2$ and k_3 respectively. The overall rate constant k is given by the expression $k = \sqrt{\frac{k_1 k_3}{k_2}}$. If the activation energies of the three steps are 60, 30 and $10 \mathrm{kJmol}^{-1}$ respectively, then the overall energy of activation in kJmol^{-1} is _____ . (Nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/Tsgz-yK8fz

Q17 JEE Main 2025 · 22 Jan · Shift 1

$\mathrm{A} \rightarrow \mathrm{B}$

The molecule A changes into its isomeric form B by following a first order kinetics at a temperature of 1000 K . If the energy barrier with respect to reactant energy for such isomeric transformation is $191.48 \mathrm{kJmol}^{-1}$ and the frequency factor is 10^{20}, the time required for 50% molecules of A to become B is _____ picoseconds (nearest integer). $\left[\mathrm{R} = 8.314 \mathrm{JK}^{-1} \mathrm{mol}^{-1}\right]$

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/1euTg82cnP

Q18 JEE Main 2024 · 29 Jan · Shift 1

For a reaction taking place in three steps at same temperature, overall rate constant $\mathrm{K} = \frac{\mathrm{K}_1 \mathrm{K}_2}{\mathrm{K}_3}$. If $\mathrm{Ea}_1, \mathrm{Ea}_2$ and Ea_3 are 40, 50 and $60 \mathrm{kJ/mol}$ respectively, the overall Ea is _____ $\mathrm{kJ/mol}$.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/m3dheFXzx-

Q19 JEE Main 2023 · 15 Apr · Shift 1

For a reversible reaction $A \rightleftharpoons B$, the $\Delta H_{\text{forward reaction}} = 20 kJ mol^{-1}$. The activation energy of the uncatalysed forward reaction is $300 kJ mol^{-1}$. When the reaction is catalysed keeping the reactant concentration same, the rate of the catalysed forward reaction at $27^{\circ}C$ is found to be same as that of the uncatalysed reaction at $327^{\circ}C$.

The activation energy of the catalysed backward reaction is _____ $kJ mol^{-1}$.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/9kuSQ5AiM1

Q20 JEE Main 2023 · 8 Apr · Shift 1

The number of given statement/s which is/are correct is _____.

(A) The stronger the temperature dependence of the rate constant, the higher is the activation energy.

(B) If a reaction has zero activation energy, its rate is independent of temperature.

(C) The stronger the temperature dependence of the rate constant, the smaller is the activation energy.

(D) If there is no correlation between the temperature and the rate constant then it means that the reaction has negative activation energy.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/rVQpsTo6Op

Q21 JEE Main 2023 · 31 Jan · Shift 1

$A \rightarrow B$

The rate constants of the above reaction at 200 K and 300 K are 0.03 min^{-1} and 0.05 min^{-1} respectively. The activation energy for the reaction is _____ J (Nearest integer)

(Given : $\ln 10 = 2.3$

$R = 8.3 J K^{-1} mol^{-1}$

$\log 5 = 0.70$

$\log 3 = 0.48$

$\log 2 = 0.30$)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/vEWgbAdg0p

Q22 JEE Main 2022 · 30 Jun · Shift 1

For the reaction P $\rightarrow$ B, the values of frequency factor A and activation energy E_A are 4×10^{13} s^{-1} and 8.3 kJ mol^{-1} respectively. If the reaction is of first order, the temperature at which the rate constant is 2×10^{-6} s^{-1} is _____ $\times 10^{-1}$ K.

(Given : ln 10 = 2.3, R = 8.3 J K^{-1} mol^{-1}, log2 = 0.30)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/HgK93VvALd

Q23 JEE Main 2022 · 29 Jun · Shift 1

The activation energy of one of the reactions in a biochemical process is 532611 J mol^{-1}. When the temperature falls from 310 K to 300 K, the change in rate constant observed is $k_{300} = x \times 10^{-3}\ k_{310}$. The value of x is _____.

[Given : $\ln 10 = 2.3$, R = 8.3 J K^{-1} mol^{-1}]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/epTUEEXB2V

Q24 JEE Main 2022 · 29 Jun · Shift 2

The equation

$k = (6.5 \times 10^{12} s^{-1}) e^{-26000K/T}$

is followed for the decomposition of compound A. The activation energy for the reaction is _____ kJ mol^{-1}. [nearest integer]

(Given : R = 8.314 J K^{-1} mol^{-1})

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/C6-PQW6cyY

Q25 JEE Main 2022 · 27 Jun · Shift 1

The rate constant for a first order reaction is given by the following equation:

$\ln k = 33.24 - \frac{2.0 \times 10^4\ K}{T}$

The activation energy for the reaction is given by _____ kJ mol^{-1}. (In nearest integer) (Given : R = 8.3 J K^{-1} mol^{-1})

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/eOz3jogXW_

Q26 JEE Main 2022 · 27 Jun · Shift 2

It has been found that for a chemical reaction with rise in temperature by 9 K the rate constant gets doubled. Assuming a reaction to be occurring at 300 K, the value of activation energy is found to be _____ kJ mol^{-1}. [nearest integer]

(Given ln10 = 2.3, R = 8.3 J K^{-1} mol^{-1}, log 2 = 0.30)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/H-dtYhUrAB

Q27 JEE Main 2022 · 26 Jun · Shift 2

Catalyst A reduces the activation energy for a reaction by 10 kJ mol^{-1} at 300 K. The ratio of rate constants, $\frac{k_{T,\,Catalysed}}{k_{T,\,Uncatalysed}}$ is e^x. The value of x is _____. [nearest integer]

[Assume that the pre-exponential factor is same in both the cases. Given R = 8.31 J K^{-1} mol^{-1}]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/kbljzSFn4B

Q28 JEE Main 2021 · 31 Aug · Shift 2

For the reaction A $\rightarrow$ B, the rate constant k(in s^{-1}) is given by

$$\log_{10}k = 20.35 - \frac{(2.47\times10^{3})}{T}$$

The energy of activation in kJ mol^{-1} is _____. (Nearest integer) [Given : R = 8.314 J K^{-1} mol^{-1}]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/a4EfBU4y9l

Q29 JEE Main 2021 · 27 Aug · Shift 2

The first order rate constant for the decomposition of $CaCO_3$ at 700 K is $6.36 \times 10^{-3}s^{-1}$ and activation energy is 209 kJ mol^{-1}. Its rate constant (in s^{-1}) at 600 K is $x \times 10^{-6}$. The value of x is _____. (Nearest integer)

[Given R = 8.31 J K^{-} mol^{-1}; log 6.36×10^{-3} = -2.19, $10^{-4.79} = 1.62 \times 10^{-5}$]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/8wxxxo42fE

Q30 JEE Main 2021 · 16 Mar · Shift 1

The decomposition of formic acid on gold surface follows first order kinetics. If the rate constant at 300 K is 1.0×10^{-3} s^{-1} and the activation energy E_a = 11.488 kJ mol^{-1}, the rate constant at 200 K is _____ $\times 10^{-5}$ s^{-1}. (Round off to the Nearest Integer). (Given : R = 8.314 J mol^{-1} K^{-1})

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/Vxb2QsXwsz

Q31 JEE Main 2021 · 26 Feb · Shift 2

If the activation energy of a reaction is 80.9 kJ mol^{-1}, the fraction of molecules at 700 K, having enough energy to react to form
products is e^{-x}. The value of x is _____. (Rounded off to the nearest integer) [Use R = 8.31 J K^{-1} mol^{-1}]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/CP9Rp2g2h_

Q32 JEE Main 2021 · 26 Feb · Shift 1

An exothermic reaction X $\rightarrow$ Y has an activation energy 30 kJ mol^{-1}. If energy change ΔE during the reaction is -20 kJ, then the activation energy for the reverse reaction in kJ is _____. (Integer answer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/g7UcyUkFZZ

Q33 JEE Main 2021 · 25 Feb · Shift 2

The rate constant of a reaction increases by five times on increase in temperature from 27°C to 52°C. The value of activation energy in kJ mol^{-1} is _____. (Rounded off to the nearest integer)

[R = 8.314 J $K^{-1}mol^{-1}$]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/68WzYAAPk6

Q34 JEE Main 2020 · 6 Sep · Shift 2

The rate of a reaction decreased by 3.555 times when the temperature was changed from 40°C to 30°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

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/hzJCfdREwY

Q35 JEE Main 2020 · 4 Sep · Shift 2

The number of molecules with energy greater than the threshold energy for a reaction increases five fold by a rise of temperature from 27°C to 42°C. Its energy of activation in J/mol is ____.

(Take ln 5 = 1.6094; R = 8.314 J mol^{-1} K^{-1})

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/4tAEGYnCA1

Q36 JEE Main 2020 · 9 Jan · Shift 1

For the following reactions

$\underset{\longrightarrow \text{Product}}{\overset{A \buildrel 700K}{}}$

$$A \underset{catalyst}{\overset{500K}{\longrightarrow}} \text{Product}$$

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):

(A) 198 kJ/mol

(B) 135 kJ/mol

(C) 105 kJ/mol

(D) 75 kJ/mol

Step-by-step solution ▸ prepwiser.in/questions/M4iKtBCVFe

Q37 JEE Main 2020 · 9 Jan · Shift 2

A sample of milk splits after 60 min. at 300 K and after 40 min. at 400 K when the population of lactobacillus acidophilus in it doubles. The activa tion energy (in kJ/ mol) for this process is closest to_____.

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

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/knMFlBXitz

Q38 JEE Main 2020 · 8 Jan · Shift 1

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 :

(A) + 6RT

(B) – 6 (2.303)RT

(C) – 6RT

(D) + 6(2.303)RT

Step-by-step solution ▸ prepwiser.in/questions/4eC-9rgLLW

Mechanisms and Catalysis · 5 PYQs

Q39 JEE Main 2025 · 4 Apr · Shift 1

For $\mathrm{A_2 + B_2 \rightleftharpoons 2AB}$

$\mathrm{E_a}$ for forward and backward reaction are 180 and $200\,\mathrm{kJ\,mol^{-1}}$ respectively

If catalyst lowers $\mathrm{E_a}$ for both reaction by $100\,\mathrm{kJ\,mol^{-1}}$.

Which of the following statement is correct?

(A) Catalyst does not alter the Gibbs energy change of a reaction.

(B) The enthalpy change for the reaction is $+20\,\mathrm{kJ\,mol^{-1}}$.

(C) Catalyst can cause non-spontaneous reactions to occur.

(D) The enthalpy change for the catalysed reaction is different from that of uncatalysed reaction.

Step-by-step solution ▸ prepwiser.in/questions/E_-alAyZ9l

Q40 JEE Main 2025 · 29 Jan · Shift 1

The reaction $A_2 + B_2 \rightarrow 2AB$ follows the mechanism:

$A_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} A + A$ (fast)

$A + B_2 \xrightarrow{k_2} AB + B$ (slow)

$A + B \rightarrow AB$ (fast)

The overall order of the reaction is:

(A) 3

(B) 2.5

(C) 1.5

(D) 2

Step-by-step solution ▸ prepwiser.in/questions/ckc_z8CteS

Q41 JEE Main 2024 · 8 Apr · Shift 2

For a reaction $A \xrightarrow{\mathrm{K_1}} \mathrm{B} \xrightarrow{\mathrm{K_2}} \mathrm{C}$ If the rate of formation of B is set to be zero then the concentration of B is given by :

(A) $(\mathrm{K_1 - K_2})[\mathrm{A}]$

(B) $(\mathrm{K_1 + K_2})[\mathrm{A}]$

(C) $\mathrm{K_1 K_2}[\mathrm{A}]$

(D) $(\mathrm{K_1/K_2})[\mathrm{A}]$

Step-by-step solution ▸ prepwiser.in/questions/D-rJPI3qj1

Q42 JEE Main 2024 · 8 Apr · Shift 1

Iron (III) catalyses the reaction between iodide and persulphate ions, in which

A. $\mathrm{Fe^{3+}}$ oxidises the iodide ion

B. $\mathrm{Fe^{3+}}$ oxidises the persulphate ion

C. $\mathrm{Fe^{2+}}$ reduces the iodide ion

D. $\mathrm{Fe^{2+}}$ reduces the persulphate ion

Choose the most appropriate answer from the options given below:

(A) B and C only

(B) A only

(C) A and D only

(D) B only

Step-by-step solution ▸ prepwiser.in/questions/tMhcJpinQw

Q43 JEE Main 2023 · 12 Apr · Shift 1

The reaction $2NO + Br_2 \rightarrow 2NOBr$

takes places through the mechanism given below:

$NO + Br_2 \Leftrightarrow NOBr_2$ (fast)

$NOBr_2 + NO \rightarrow 2NOBr$ (slow)

The overall order of the reaction is _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/GBEMqkka3y

Half-Life · 19 PYQs

Q44 JEE Main 2025 · 8 Apr · Shift 2

In a first order decomposition reaction, the time taken for the decomposition of reactant to one fourth and one eighth of its initial concentration are t_1 and t_2 (s), respectively. The ratio t_1/t_2 will be:

(A) $\frac{4}{3}$

(B) $\frac{3}{2}$

(C) $\frac{3}{4}$

(D) $\frac{2}{3}$

Step-by-step solution ▸ prepwiser.in/questions/Q3rhQiok43

Q45 JEE Main 2025 · 3 Apr · Shift 1

In a reaction $A + B \rightarrow C$, initial concentrations of A and B are related as $[A]_0 = 8[B]_0$. The half lives of A and B are 10 min and 40 min , respectively. If they start to disappear at the same time, both following first order kinetics, after how much time will the concentration of both the reactants be same?

(A) 20 min

(B) 40 min

(C) 80 min

(D) 60 min

Step-by-step solution ▸ prepwiser.in/questions/cC_Bt12MJs

Q46 JEE Main 2024 · 6 Apr · Shift 2

Consider the two different first order reactions given below

$$\mathrm{A} + \mathrm{B} \rightarrow \mathrm{C}\ (\text{Reaction 1})$$
$$\mathrm{P} \rightarrow \mathrm{Q}\ (\text{Reaction 2})$$

The ratio of the half life of Reaction 1 : Reaction 2 is $5 : 2$ If t_1 and t_2 represent the time taken to complete $2/3^{\text{rd}}$ and $4/5^{\text{th}}$ of Reaction 1 and Reaction 2 , respectively, then the value of the ratio $t_1 : t_2$ is _____ $\times 10^{-1}$ (nearest integer). [Given : $\log_{10}(3) = 0.477$ and $\log_{10}(5) = 0.699$]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/6KF7pzNh6p

Q47 JEE Main 2024 · 6 Apr · Shift 1

Time required for 99.9% completion of a first order reaction is _____ times the time required for completion of 90% reaction.(nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/YJhC2IqjbM

Q48 JEE Main 2024 · 30 Jan · Shift 1

The rate of First order reaction is $0.04 \mathrm{molL}^{-1} \mathrm{s}^{-1}$ at 10 minutes and $0.03 \mathrm{molL}^{-1} \mathrm{s}^{-1}$ at 20 minutes after initiation. Half life of the reaction is _____ minutes.

(Given $\log 2 = 0.3010, \log 3 = 0.4771$)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/1bcpdncVQR

Q49 JEE Main 2024 · 27 Jan · Shift 2

Time required for completion of 99.9% of a First order reaction is _____ times of half life $\left(t_{1/2}\right)$ of the reaction.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/n3X1DP1LY1

Q50 JEE Main 2023 · 13 Apr · Shift 1

$\mathrm{t}_{87.5}$ is the time required for the reaction to undergo 87.5% completion and t_{50} is the time required for the reaction to undergo 50% completion. The relation between $\mathrm{t}_{87.5}$ and t_{50} for a first order reaction is $\mathrm{t}_{87.5} = x \times \mathrm{t}_{50}$ The value of x is _____. (Nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/LazGkR0xtx

Q51 JEE Main 2023 · 25 Jan · Shift 1

For the first order reaction A $\rightarrow$ B, the half life is 30 min. The time taken for 75% completion of the reaction is _____ min. (Nearest integer)

Given : log 2 = 0.3010

log 3 = 0.4771

log 5 = 0.6989

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/WiJo8-QRU2

Q52 JEE Main 2022 · 28 Jul · Shift 1

For the given first order reaction

$\mathrm{A} \rightarrow \mathrm{B}$

the half life of the reaction is $0.3010 \mathrm{min}$. The ratio of the initial concentration of reactant to the concentration of reactant at time $2.0 \mathrm{min}$ will be equal to _____. (Nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/0IGeqaUT1M

Q53 JEE Main 2022 · 27 Jul · Shift 2

$$\underset{\text{Reactant}}{[A]} \rightarrow \underset{\text{Product}}{[B]}$$

If formation of compound $[\mathrm{B}]$ follows the first order of kinetics and after 70 minutes the concentration of $[\mathrm{A}]$ was found to be half of its initial concentration. Then the rate constant of the reaction is $x \times 10^{-6} \mathrm{s}^{-1}$. The value of x is _____. (Nearest Integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/1EhbOl45oy

Q54 JEE Main 2022 · 26 Jul · Shift 2

At $30^{\circ}C$, the half life for the decomposition of AB_2 is $200s$ and is independent of the initial concentration of AB_2. The time required for 80% of the AB_2 to decompose is

Given: $\log 2 = 0.30 \quad \log 3 = 0.48$

(A) 200 s

(B) 323 s

(C) 467 s

(D) 532 s

Step-by-step solution ▸ prepwiser.in/questions/fgSnYWwUie

Q55 JEE Main 2022 · 25 Jul · Shift 1

The half life for the decomposition of gaseous compound A is $240s$ when the gaseous pressure was 500 Torr initially. When the pressure was 250 Torr, the half life was found to be 4.0 min. The order of the reaction is _____. (Nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/gPGCHuL3V3

Q56 JEE Main 2022 · 28 Jun · Shift 1

For a first order reaction A $\rightarrow$ B, the rate constant, k = 5.5 $\times$ 10^{-14} s^{-1}. The time required for 67% completion of reaction is x $\times$ 10^{-1} times the half life of reaction. The value of x is _____ (Nearest integer)

(Given : log 3 = 0.4771)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/bY546R1rKM

Q57 JEE Main 2022 · 26 Jun · Shift 1

A flask is filled with equal moles of A and B. The half lives of A and B are 100 s and 50 s respectively and are independent of the initial concentration. The time required for the concentration of A to be four times that of B is _____ s.

(Given : ln 2 = 0.693)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/lfAxRojd8P

Q58 JEE Main 2022 · 25 Jun · Shift 2

At 345 K, the half life for the decomposition of a sample of a gaseous compound initially at 55.5 kPa was 340 s. When the pressure was 27.8 kPa, the half life was found to be 170 s. The order of the reaction is _____. [integer answer]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/Z2TLjJsdED

Q59 JEE Main 2021 · 18 Mar · Shift 2

A reaction has a half life of 1 min. The time required for 99.9% completion of the reaction is _____ min. (Round off to the Nearest Integer). [Use : ln 2 = 0.69; ln 10 = 2.3]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/3YUAKRuH7Y

Q60 JEE Main 2021 · 16 Mar · Shift 2

A and B decompose via first order kinetics with half-lives 54.0 min and 18.0 min respectively. Starting from an equimolar non reactive mixture of A and B, the time taken for the concentration of A to become 16 times that of B is _____ min. (Round off to the Nearest Integer).

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/ct5JoXYwcN

Q61 JEE Main 2021 · 24 Feb · Shift 2

Sucrose hydrolyses in acid solution into glucose and fructose following first order rate law with a half-life of 3.33 h at 25°C. After 9 h, the fraction of sucrose remaining is f. The value of $\log_{10}\left(\frac{1}{f}\right)$ is _____ $\times 10^{-2}$. (Rounded off to the nearest integer)

[Assume : ln 10 = 2.303, ln 2 = 0.693]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/eQAbgOQSWk

Q62 JEE Main 2020 · 5 Sep · Shift 1

A flask contains a mixture of compounds A and B. Both compounds decompose by first-order kinetics. The half-lives for A and B are 300 s and 180 s, 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)

(A) 180
(B) 120
(C) 300
(D) 900

Step-by-step solution ▸ prepwiser.in/questions/NAgqCkiZ6y

Zero and First Order Reactions · 17 PYQs

Q63 JEE Main 2025 · 4 Apr · Shift 2

Half life of zero order reaction $A \rightarrow$ product is 1 hour, when initial concentration of reactant is $2.0 \mathrm{molL}^{-1}$. The time required to decrease concentration of A from 0.50 to $0.25 \mathrm{molL}^{-1}$ is :

(A) 0.5 hour
(B) 15 min
(C) 60 min
(D) 4 hour

Step-by-step solution ▸ prepwiser.in/questions/LrC5LI1PJ9

Q64 JEE Main 2025 · 29 Jan · Shift 2

Drug X becomes ineffective after 50% decomposition. The original concentration of drug in a bottle was $16 \mathrm{mg/mL}$ which becomes $4 \mathrm{mg/mL}$ in 12 months. The expiry time of the drug in months is _____.
Assume that the decomposition of the drug follows first order kinetics.

(A) 12
(B) 3
(C) 6
(D) 2

Step-by-step solution ▸ prepwiser.in/questions/Gyp24X4nZU

Q65 JEE Main 2024 · 9 Apr · Shift 2

Consider the following first order gas phase reaction at constant temperature

$$\mathrm{A(g) \rightarrow 2B(g) + C(g)}$$

If the total pressure of the gases is found to be 200 torr after 23 sec. and 300 torr upon the complete decomposition of A after a very long time, then the rate constant of the given reaction is _____ $\times 10^{-2} \mathrm{s}^{-1}$ (nearest integer)

[Given : $\log_{10}(2) = 0.301$]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/VTogoHwfwg

Q66 JEE Main 2024 · 8 Apr · Shift 1

Consider the following reaction

$\mathrm{A + B \rightarrow C}$

The time taken for A to become $1/4^{\mathrm{th}}$ of its initial concentration is twice the time taken to become $1/2$ of the same. Also, when the change of concentration of B is plotted against time, the resulting graph gives a straight line with a negative slope and a positive intercept on the concentration axis.

The overall order of the reaction is _____.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/aPR5mvVGXZ

Q67 JEE Main 2024 · 31 Jan · Shift 2

$\mathrm{r = k[A]}$ for a reaction, 50% of A is decomposed in 120 minutes. The time taken for 90% decomposition of A is _____ minutes.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/JHgpKp6_LJ

Q68 JEE Main 2024 · 31 Jan · Shift 1

Integrated rate law equation for a first order gas phase reaction is given by (where $\mathrm{P_i}$ is initial pressure and $\mathrm{P_t}$ is total pressure at time t)

(A) $k = \frac{2.303}{t} \times \log \frac{P_i}{(2P_i - P_t)}$

(B) $\mathrm{k = \dfrac{2.303}{t} \times \log \dfrac{(2P_i - P_t)}{P_i}}$

(C) $k = \frac{2.303}{t} \times \frac{P_i}{(2P_i - P_t)}$

(D) $\mathrm{k = \dfrac{2.303}{t} \times \log \dfrac{2P_i}{(2P_i - P_t)}}$

Step-by-step solution ▸ prepwiser.in/questions/oHkInbmkY5

Q69 JEE Main 2023 · 13 Apr · Shift 2

A(g) $\rightarrow$ 2B(g) + C(g) is a first order reaction. The initial pressure of the system was found to be 800 mm Hg which increased to 1600 mm Hg after 10 min. The total pressure of the system after 30 min will be _____ mm Hg. (Nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/K0sLH1Chuk

Q70 JEE Main 2023 · 31 Jan · Shift 2

The rate constant for a first order reaction is 20min^{-1}. The time required for the initial concentration of the reactant to reduce to its $\frac{1}{32}$ level is _____ $\times 10^{-2}\text{min}$. (Nearest integer)

(Given : $\ln 10 = 2.303$ and $\log 2 = 0.3010$)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/HmZpcZ4wp_

Q71 JEE Main 2023 · 30 Jan · Shift 1

If compound A reacts with B following first order kinetics with rate constant $2.011 \times 10^{-3}\text{s}^{-1}$. The time taken by A (in seconds) to reduce from 7g to 2g will be _____. (Nearest Integer)

$[\log 5 = 0.698, \log 7 = 0.845, \log 2 = 0.301]$

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/wN_4nUC8ns

Q72 JEE Main 2023 · 25 Jan · Shift 2

A first order reaction has the rate constant, $k = 4.6 \times 10^{-3}\text{s}^{-1}$. The number of correct statement/s from the following is/are _____

Given : $\log 3 = 0.48$

A. Reaction completes in 1000 s.

B. The reaction has a half-life of 500 s.

C. The time required for 10% completion is 25 times the time required for 90% completion.

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

E. The rate and the rate constant have the same unit.

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/Ho_F_ywzrO

Q73 JEE Main 2022 · 26 Jul · Shift 1

For a reaction $A \rightarrow 2B + C$ the half lives are 100s and 50s when the concentration of reactant A is 0.5 and 1.0molL^{-1} respectively. The order of the reaction is _____ . (Nearest Integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/Smn784rL5M

Q74 JEE Main 2022 · 24 Jun · Shift 2

For a first order reaction, the time required for completion of 90% reaction is 'x' times the half life of the reaction. The value of 'x' is

(Given : ln 10 = 2.303 and log 2 = 0.3010)

(A) 1.12 **(B)** 2.43

(C) 3.32 **(D)** 33.31

Step-by-step solution ▸ prepwiser.in/questions/6rkAFTPCFN

Q75 JEE Main 2021 · 31 Aug · Shift 1

For a first order reaction, the ratio of the time for 75% completion of a reaction to the time for 50% completion is _____. (Integer answer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/KJdgO6sYbh

Q76 JEE Main 2021 · 22 Jul · Shift 2

$N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$

In the above first order reaction the initial concentration of N_2O_5 is 2.40×10^{-2} mol L^{-1} at 318 K. The concentration of N_2O_5 after 1 hour was 1.60×10^{-2} mol L^{-1}. The rate constant of the reaction at 318 K is _____ $\times 10^{-3}$ min^{-1}. (Nearest integer)

[Given : log 3 = 0.477, log 5 = 0.699]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/SUL84WqXOq

Q77 JEE Main 2021 · 20 Jul · Shift 1

The inactivation rate of a viral preparation is proportional to the amount of virus. In the first minute after preparation, 10% of the virus is inactivated. The rate constant for viral inactivation is _____ $\times 10^{-3}$ min^{-1}. (Nearest integer)

[Use : ln 10 = 2.303; $\log_{10}$ 3 = 0.477; property of logarithm : log x^y = y log x]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/8BLTxIlQfl

Q78 JEE Main 2021 · 20 Jul · Shift 2

$PCl_5(g) \rightarrow PCl_3(g) + Cl_2(g)$

In the above first order reaction the concentration of PCl_5 reduces from initial concentration 50 mol L^{-1} to 10 mol L^{-1} in 120 minutes at 300 K. The rate constant for the reaction at 300 K is x $\times 10^{-2}$ min^{-1}. The value of x is _____. [Given log5 = 0.6989]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/LvOItgmmaq

Q79 JEE Main 2021 · 17 Mar · Shift 1

For a certain first order reaction 32% of the reactant is left after 570s. The rate constant of this reaction is _____ $\times 10^{-3}$ s^{-1}. (Round off to the Nearest Integer). [Given : $\log_{10}2$ = 0.301, ln10 = 2.303]

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/pRzO74r1Ek

Rate Law and Order · 11 PYQs

Q80 JEE Main 2025 · 28 Jan · Shift 2

Consider an elementary reaction

$$\mathrm{A(g) + B(g) \rightarrow C(g) + D(g)}$$

If the volume of reaction mixture is suddenly reduced to $\frac{1}{3}$ of its initial volume, the reaction rate will become ' x' times of the original reaction rate. The value of x is :

(A) 3

(B) 9

(C) $\frac{1}{3}$

(D) $\frac{1}{9}$

Step-by-step solution ▸ prepwiser.in/questions/xhhBae-fF4

Q81 JEE Main 2024 · 5 Apr · Shift 2

Consider the following single step reaction in gas phase at constant temperature.

$$\mathrm{2A_{(g)} + B_{(g)} \rightarrow C_{(g)}}$$

The initial rate of the reaction is recorded as $\mathrm{r_1}$ when the reaction starts with $1.5\mathrm{atm}$ pressure of A and $0.7\mathrm{atm}$ pressure of B. After some time, the rate r_2 is recorded when the pressure of C becomes $0.5\mathrm{atm}$. The ratio $\mathrm{r_1 : r_2}$ is _____ $\times 10^{-1}$. (Nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/bqvwtzDuhd

Q82 JEE Main 2024 · 4 Apr · Shift 2

Consider the following reaction, the rate expression of which is given below

$$\mathrm{A + B \rightarrow C}$$
$$\mathrm{rate} = \mathrm{k[A]^{1/2}[B]^{1/2}}$$

The reaction is initiated by taking $1\mathrm{M}$ concentration of A and B each. If the rate constant (k) is $4.6 \times 10^{-2}\mathrm{s}^{-1}$, then the time taken for A to become $0.1\mathrm{M}$ is _____ sec. (nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/T0DkaMKHsw

Q83 JEE Main 2023 · 11 Apr · Shift 2

For a chemical reaction $\mathrm{A} + \mathrm{B} \rightarrow$ Product, the order is 1 with respect to A and B.

Rate $\mathrm{molL^{-1}S^{-1}}$	$[\mathrm{A}]$ $\mathrm{molL^{-1}}$	$[\mathrm{B}]$ $\mathrm{molL^{-1}}$
0.10	20	0.5
0.40	x	0.5
0.80	40	y

What is the value of x and y ?

(A) 80 and 4

(B) 160 and 4

(C) 80 and 2

(D) 40 and 4

Step-by-step solution ▸ prepwiser.in/questions/K8KeMYQbbu

Q84 JEE Main 2023 · 10 Apr · Shift 1

A molecule undergoes two independent first order reactions whose respective half lives are 12 min and 3 min. If both the reactions are occurring then the time taken for the 50% consumption of the reactant is _____ min. (Nearest integer)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/8f1Plu0D40

Q85 JEE Main 2023 · 10 Apr · Shift 2

The number of **incorrect** statement/s from the following is _____

A. The successive half lives of zero order reactions decreases with time.

B. A substance appearing as reactant in the chemical equation may not affect the rate of reaction

C. Order and molecularity of a chemical reaction can be a fractional number

D. The rate constant units of zero and second order reaction are $\mathrm{molL^{-1}s^{-1}}$ and $\mathrm{mol^{-1}Ls^{-1}}$ respectively

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/WxnsjUPXvC

Q86 JEE Main 2023 · 30 Jan · Shift 2

An organic compound undergoes first-order decomposition. If the time taken for the 60% decomposition is $540\mathrm{s}$, then the time required for 90% decomposition will be _____ s. (Nearest integer).

Given: $\ln 10 = 2.3; \log 2 = 0.3$

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/nFKIBuuNXi

Q87 JEE Main 2021 · 27 Jul · Shift 1

For a reaction of order n, the unit of the rate constant is :

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

(B) $mol^{1-n}\ L^{2n}\ s^{-1}$

(C) $mol^{1-n}\ L^{n-1}\ s^{-1}$

(D) $mol^{1-n}\ L^{1-n}\ s^{-1}$

Step-by-step solution ▸ prepwiser.in/questions/qihbgqAryj

Q88 JEE Main 2021 · 18 Mar · Shift 1

$2NO(g) + Cl_2(g) \rightleftharpoons 2NOCl(s)$

This reaction was studied at -10° and the following data was obtained

Run	$[NO]_0$	$[Cl_2]_0$	r_0
1	0.10	0.10	0.18
2	0.10	0.20	0.35
3	0.20	0.20	1.40

$[NO]_0$ and $[Cl_2]_0$ are the initial concentrations and r_0 is the initial reaction rate.

The overall order of the reaction is _____. (Round off to the Nearest Integer).

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/V6VoU3ivRC

Q89 JEE Main 2021 · 17 Mar · Shift 2

The reaction $2A + B_2 \rightarrow 2AB$ 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).

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/PCempB8o-f

Q90 JEE Main 2020 · 4 Sep · Shift 1

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; log 2.5 = 0.40)

Numerical answer — enter the value.

Step-by-step solution ▸ prepwiser.in/questions/Tzqs52jqBe

Answer key — Chemical Kinetics

Numbers match the question numbers above. For full working, open the solution link under each question.

1	**17**	2	**333**	3	**D**	4	**A**	5	**A**	6	**2**	7	**1**	8	**4**
9	**4**	10	**B**	11	**3**	12	**2**	13	**40**	14	**B**	15	**C**	16	**20**
17	**69**	18	**30**	19	**130**	20	**2**	21	**2520**	22	**225**	23	**1**	24	**216**
25	**166**	26	**59**	27	**4**	28	**47**	29	**16**	30	**10**	31	**14**	32	**50**
33	**52**	34	**100**	35	**84297**	36	**D**	37	**3**	38	**B**	39	**A**	40	**C**
41	**D**	42	**C**	43	**3**	44	**D**	45	**B**	46	**17**	47	**3**	48	**24**
49	**10**	50	**3**	51	**60**	52	**100**	53	**165**	54	**C**	55	**1**	56	**16**
57	**200**	58	**0**	59	**10**	60	**108**	61	**81**	62	**D**	63	**B**	64	**C**
65	**3**	66	**1**	67	**399**	68	**A**	69	**2200**	70	**17**	71	**623**	72	**1**
73	**2**	74	**C**	75	**2**	76	**7**	77	**106**	78	**1**	79	**2**	80	**B**
81	**315**	82	**50**	83	**C**	84	**2**	85	**1**	86	**1350**	87	**C**	88	**3**
89	**27**	90	**60**												