Q1. Express the rate of the following reaction in terms of different reactants and products $4NH_{3\,(g)} + 5\,O_{2\,(g)} \rightarrow 4NO_{(g)} + 4H_2O_{(g)}$ if the rate of formation of NO is 3 6 x 10^{-3} mol L calculate the rate of disappearance of NH_3 rate of formation of H_2O.

Q2. The rate constant of a reaction is $3x10^2\ h^{-1}$ what is the order of reaction?

Q3. Time for half change for a first order reaction is 25 minutes. What time will be required for 99% reaction?

Q4. Identify the order if a reaction if the rate constant has the units' liter/mole/sec.

Q5. The half-life period of a first order reaction is 60 minutes. What percentage of the reactant will be left behind after 120 minutes?

Q6. For a gaseous reaction $2A + B_2 \rightarrow 2AB$ the following rate data were obtained at 300 K

Rate of disappearance of B_2 (mol l^{-1} min^{-1})	concentration [A]	[B]
1.8×10^{-3}	0.015	0.15
1.08×10^{-2}	0.09	0.15
5.4×10^{-3}	0.015	0.45

Calculate the rate constant for the reaction and rate of formation of AB when [A] is 0.02 and [B] is 0.04 mol/lit

Q7. The rate of reaction $A + B \rightarrow$ Products is given by Rate = k $[A]^{½}$ $[B]^2$ What are the units of the rate constant?

Q8. The rate constant of a first order reaction becomes 6 times when the temperature is increased from 350 K to 410 K. Calculate the energy of activation for the reaction.

Q9. A first order reaction is 20% complete in 5 minutes. In what time will the reaction be 60% complete?

Q10. The rate constants for reaction are 1x 10^{-3} sec^{-1} and 2 x 10^{-3} sec^{-1} at 27°C and 37°C respectively. Calculate the activation energy of the reaction?

Q11. Thermal decomposition of a compound is of first order. If 50% of the compound is decomposed in 120 minutes, how long will it take for 90% of the compound to decompose?

Q12. Three experimental runs were carried out for reaction between Cl_2 and NO

$Cl_{2\,(g)} + 2\,NO_{(g)} \rightarrow 2NOCl_{(g)}$ The following data were obtained:

Expt.	[Cl2] mol L^{-1}	[NO] mol L^{-1}	Initial rate mol $L^{-1}s^{-1}$
1	0.020	0.010	2.4×10^{-4}
2	0.020	0.030	2.16×10^{-3}
3	0.040	0.030	4.32×10^{-3}

Determine (i) the orders w.r.t. Cl_2 and NO, (ii) the rate law and (iii) the rate constant.

Q13. The decomposition of N_2O_5 in carbon tetrachloride solution was studied N_2O_5 (solution) $\rightarrow 2NO_2$ (solution) + ½ $O_{2\,(g)}$ The reaction has been found to be first order and the rate constant is found to be 6.2 x 10^{-4} s^{-1}. Calculate the rate of reaction when (a) $[N_2O_5]$ = 1.25 mol/L and (b) $[N_2O_5]$ = 0.25 mol/L (c) What concentration of N_2O_5 would give a rate of 2.4 x 10^{-3} mol/L/s

Q14. A substance decomposes following first order kinetics. If the half-life of the reaction is 35 minutes, what is the rate constant of the reaction?

Q15. The three-fourth of a first order reaction is completed in 32 minutes. What is the half-life period of the reaction

Q16. First order reaction is 75% complete in 60 minutes. Find the half-life of this reaction,

Q17. For a reaction, the energy of activation is zero. What is the value of rate constant at 300 K, if $k=1.6\times10^{6}\ s^{-1}$ 280K?

Q18. A chemical reaction $2A \leftrightarrows 4B + C$ in gas phase occurs in a closed vessel. The concentration of B is found to be increased by 5×10^{-3} mole/L in 10 seconds. Calculate (i) the rate of appearance of B (ii) the rate of disappearance of A.

Q19. In a particular reduction process, the concentration of a solution that is initially 0.24 M is reduced to 0.12M in 10.hours and 0.06 M in20 hours. What is the rate constant of this reaction?

Q20. The rate of a particular reaction quadruples when the temperature changes from 293K to 313 K Calculate the energy of activation for such a reaction.

Q21. The initial rate of a reaction A + B → C was measured for several concentrations of A and B. The observations made are recorded in the following table:

Expt.	[A]	[B]	Rate
	mol/L	mol/L	mol $L^{-1}s^{-1}$
1	0.100	0.100	4.0×10^{-5}
2	0.100	0.200	4.0×10^{-5}
3	0.200	0.100	16.0×10^{-5}

Using the data in the above table, determine (a) the rate law for the reaction (b) the magnitude of the rate constant.

Q22. Show by using rate law, how 'much rate of the reaction $2NO + O_2 \rightarrow 2NO_2$ will change if the volume of the reaction vessel is reduced to one third of its initial value?

Q23. The values of the rate constant of a first order reaction are 45.1 $minute^{-1}$ and 576 $minute^{-1}$ at 20° C and 40°C respectively. Calculate the activation energy of the reaction

Q24. Half change time for a first order reaction is 20 minutes. What is its rate constant?

Q25. In a reaction, 5g ethyl acetate is hydrolyzed per litre in the presence of dil HCI in 300 minutes. If the reaction is of first order and the initial concentration of ethyl acetate is 22g/L, calculate the rate constant of the reaction?

Q26. The activation energy of reaction is 94.14 kJ/mol and the value of rate constant at 313 K is $1.8 \times 10^{-5}\ sec^{-1}$ Calculate time frequency factor A.

Q27. The reaction takes place in a closed vessel

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

It is observed that the concentration of NO_2 increases by 1.6×10^{-2} mol/litre in four seconds. Calculate the rate of reaction and rate of change of concentration of N_2O_5.

Q28. For a chemical reaction $3A \rightarrow B + 2C$ the rate of formation of C is 0.024 M/sec. What will be the rate of disappearance of A?

Q29. For the reaction $A_2 + 3B_2 \rightleftharpoons 2AB_3$ the rate of reaction measured as $\frac{d[AB_3]}{dt}$ was found to be $2.4 \times l0^{-4}$ Mol/sec Calculate the rate of reaction expressed in terms of (i) A_2 and (ii) B_2.

Q30. The experimental rate law for the reaction

$$2\ NO_2^{-1} + 4H^+ + 2I^{-1} \rightarrow I_2 + 2NO + 2\ H_2O$$

is $r = k[NO_2^{-1}][I^{-1}][H^+]^2$ How would the rate (r) of the reaction be altered if

(a) $[H^+]$ and $[I^{-1}]$ were kept constant but $[NO_2]$ was doubled?

(b) $[I^{-1}]$ and $[NO_2]$ were kept constant but $[H^+]$ was doubled?

(c) $[I^{-1}]$ and $[NO_2]$ were kept constant but $[H^+]$ was halved?

(d) All concentrations were doubled?