Name :..... Total Marks = 127
Time : 6 hr Date: 23/10/2017

Q1. In a reaction between *A* and *B*, the initial rate of reaction was measured for differential initial concentrations of *A* and *B* as given below: **3**

A/mol L^{-1}	0.20	0.20	0.40
B/mol L^{-1}	0.30	0.10	0.05
r_0/mol $L^{-1}s^{-1}$	5.07×10^{-5}	5.07×10^{-5}	7.6×10^{-5}

What is the order of reaction with respect to *A* and *B*?

Q2. Outline the principles of refining of metals by the following methods: **3**
(a) Electrolytic refining (b) Vapour phase refining

Q3. The following results have been obtained during the kinetic studies of the reaction: **3**

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

Experiment	[*A*]/M	[*B*]/M	Initial rate of formation of D/M min^{-1}
I	0.1	0.1	6.0×10^{-3} mol L^{-1} min^{-1}
II	0.3	0.2	7.2×10^{-2} mol L^{-1} min^{-1}
III	0.3	0.4	2.88×10^{-1} mol L^{-1} min^{-1}
IV	0.4	0.1	2.4×10^{-2} mol L^{-1} min^{-1}

Determine the rate law and the rate constant for the reaction.

Q4. During nuclear explosion, one of the products is ^{90}Sr with half life of 28.1 y. If 1 µg of ^{90}Sr was absorbed in the bones of a newly born baby instead of calcium, how much of it will remain after 10 years and 60 years if it is not lost metabolically. **3**

Q5. The reaction between *A* and *B* is first order with respect to *A* and zero order with respect to *B*. Fill in the blanks in the following table: **3**

Experiment	[*A*]/M	[*B*]/M	Initial rate/M min^{-1}
I	0.1	0.1	2.0×10^{-2}
II	—	0.2	4.0×10^{-2}
III	0.4	0.4	—
IV	—	0.2	2.0×10^{-2}

Q6. For the decomposition of a zoisopropane to hexane and nitrogen at 543 K, the following data is obtained. **3**

$$(CH_3)_2\,CHN = NCH\,(CH_3)_2 \longrightarrow N_2 + C_6H_{14}$$

T (sec)	*p* (mm of Hg)
0	35.0
360	54.0
720	63.0

Calculate the rate constant.

Q7. Consider a certain reaction, A → products with $k = 2.0 \times 10^{-2}\ s^{-1}$. Calculate the concentration of A remaining after 100 *s* if initial concentration of A is 1.0 mol L^{-1}. 3

Q8. The rate constant for the first order decomposition of H_2O_2 is given by the equation: 3

$$\log k = 14.34 - 1.25 \times 10^4\ K/T$$

Calculate Ea for this reaction and at what temperature will its $t_{1/2}$ be 256 minutes?

Q9. The decomposition of A into product has value of k as $4.5 \times 10^3 s^{-1}$ at 10°C and energy of activation 60 kJ mol^{-1}. At what temperature would K be $1.5 \times 10^4 s^{-1}$? 3

Q10. The following data were obtained during the first order thermal decomposition of $SO_2Cl_2(g)$ at constant volume. 3

$$SO_2Cl_2\ (g) \longrightarrow SO_2\ (g) + Cl_2(g)$$

Experiment	Time/s^{-1}	Total pressure/atm
1	0	0.5
2	100	0.6

Calculate the rate of reaction when total pressure is 0.65 atm.

Q11. A reactions is second order with respect to a reactant. How is the rate of reaction affected if the concentration of the reactant is 3

(a) doubled (b) reduced to 1/2

Q12. The time required for 10% completion of a first order reaction at 298 K is equal to that required for its 25% completion at 308 K. If the value of A is $4 \times 10^{10}\ s^{-1}$, calculate *k* at 308 K and E*a*. 3

Q13. The half-life period of a first order reaction is 30 minutes. Calculate the specific reaction rate of the reaction. What fraction of the reactant remains after 70 minutes? 3

Q14. The reaction, $2N_2O_5 \rightarrow 4NO_2 + O_2$, is forming NO_2 at the rate of 0.0072 mole/L/s at some time. 3

(a) What is the rate of change of $[O_2]$ at this time?

(b) What is the rate of change of $[N_2O_5]$ at this time?

(c) What is the rate of reaction at this time?

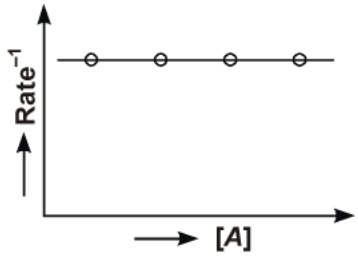
Q15. For $2A + B + C \longrightarrow$ Products, calculate: 3

(a) Rate expression (b) Units of rate and rate constant.

(c) Effect on rate, if the concentration of *A* is doubled and that of *B* is tripled.

Q16. $2A + 3B \longrightarrow$ Product 3

What is order w.r.t. *A* and *B* in the following cases:



(a) When $\left(\frac{dx}{dt}\right) = k[A]$ and *B* is in excess.

(b) when $\left(\frac{dx}{dt}\right) = k[B]^2$ and graph is true.

(c) When the rate is doubled, then the concentration of *A* is doubled, and the rate is eight times when the concentration of *A* and *B* is doubled.

Q17. The decomposition of a compound is found to follow a first-order rate law. If it takes 15 minutes for 20 percent of original material to react, calculate (a) the specific rate constant, (b) the time at which 10 percent of the original material remains unreacted, (c) the time it takes for the next 20 percent of the reactant left to react first 15 minutes. 3

Q18. First order reaction is 15% complete in 20 minutes. How long will it take to be 60% complete? 3

Q19. The catalytic decomposition of hydrogen peroxide was studied by titrating it at different intervals with $KMnO_4$, Calculate the rate constant from the following data, assuming the reaction to be of first order: 3

t (secs.)	0	600	1,200
$KMnO_4$ (ml.)	22.8	13.8	8.2

Q20. A first order reaction is 20% complete in 10 minutes. Calculate the time for 75% completion of the reaction. 3

Q21. A certain reaction is 50% complete in 20 minutes at 300 K and the same reaction is again 50% complete in 5 minutes at 350 K. Calculate energy of activation if it is a reaction of first order. 3

Q22. What is an adsorption isothermal? Describe Freundlich adsorption isotherm. 3

Q23. Consider the data for the reaction between *A* and *B*. 3

[A] (mol L^{-1})	[B] (mol L^{-1})	Initial rate (mol L^{-1} s^{-1})	
		At 300 K	At 320 K
2.5×10^{-4}	3.0×10^{-5}	5×10^{-4}	2×10^{-3}
5.0×10^{-4}	6.0×10^{-5}	4×10^{-3}	—
1.0×10^{-4}	6.0×10^{-5}	1.6×10^{-2}	—

Calculate:

(a) order w.r.t. *A* and *B* (b) rate constant at 300

(c) the energy of activation (d) the pre-exponential factor

Q24. In a pseudo first order hydrolysis of ester in water the following results were obtained: 3

t/s	0	30	60	90
[Ester]/M	0.55	0.31	0.17	0.085

(a) Calculate the average rate of reaction between the time interval 30 to 60 seconds.

(b) Calculate the pseudo first order rate constant for the hydrolysis of ester.

Q25. In general, it observed that the rate of a chemical reaction doubles with every 10° rise in temperature. If this generalisation holds good for the reaction in the temperature range 295 K to 305 K, what would be the value of activation energy for this reaction? (R = 9.314 J K^{-1} mol^{-1}) 3

Q26. Answer the following: 3

(a) Why silica gel is used as dehumidizer?

(b) What is the significance of a gold number?

(c) Ferric hydroxide sol coagulates on addition of aqueous solution of sodium sulphate.

Q27. (a) In which of the following does adsorption take place and why? 3

(i) Silica gel placed in the atmosphere saturated with water.

(ii) Anhydrous $CaCl_2$ placed in the atmosphere saturated with water.

(b) How does BF_3 act as a catalyst in industrial process?

(c) Give an example of shape-selective catalysis.

Q28. Describe the following types of colloids, giving an example for each: 3

(a) Multimolecular colloids (b) Macromolecular colloids

Q29. Explain what is observed when: 3

(a) An electrolyte, KCl is added to hydrated ferric oxide sol.

(b) An electric current is passed through a colloidal solution.

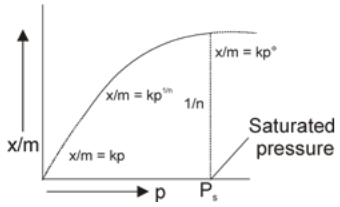
(c) A beam of strong light is passed through a colloidal solution.

Q30. Explain the following terms: 3

(a) Peptization (b) Dialysis (c) Hardy-Schulze rule.

Q31. The choice of a reducing agent in a particular case depends on thermodynamic factor. How far do you agree with this statement? Support your opinion with two examples. 3

Q32. Discuss the effect of pressure and temperature on the adsorption of gases on solids. 3



Q33. Write down the reactions taking place in different zones in the blast furnace during the extraction of iron. 3

Q34. Write chemical reactions taking place in the extraction of zinc from zinc blende. 3

Q35. State the role of silica in the metallurgy of copper. 3

Q36. How can you separate a alumina from bauxite ore associated with silica? Give equations. 3

Q37. (a) Name the processes from which chlorine is obtained as a by-product. 3

(b) What will happen if an aqueous solution of NaCl is subjected to electrolysis?

Q38. Suggest a condition under which magnesium could reduce aluminia. 3

Q39. Explain: (1) Zone refining (2) Column chromatography. 3

Q40. The rate constant for the decomposition of N_2O_5 at various temperature is given below: 5

T^{10}/C	0	20	40	60	80
$10^5 \times k/s^{-1}$	0.0787	1.70	25.7	178	2140

Draw a graph between in k and $1/T$ and calculate the values of A and E_a. Predict the rate constant at 30° and 50°C.

Q41. The experimental data for decomposition of N_2O_5 [$2N_2O_5 \longrightarrow 4NO_2 + O_2$] in gas phase at 318 K are given below : 5

Time/seconds	0	400	800	1200	1600
$10^{-2} \times [N_2O_5]/M$	1.65	1.36	1.14	0.93	0.78
Time/seconds	**2000**	**2400**	**2800**	**3200**	
$10^{-2} \times [N_2O_5]/M$	0.64	0.53	0.43	0.35	

(a) Plot (N_2O_5) against t. (b) Find the half life period for the reaction.

(c) Calculate the half life period from k and compare it with answer (b).