



UNIVERSITY EXAMINATIONS

FIRST SEMESTER 2025/2026 ACADEMIC YEAR

**THIRD YEAR EXAMINATION FOR THE DEGREE OF
BACHELOR OF EDUCATION (SCIENCE) AND BACHELOR
OF SCIENCE (GENERAL)**

CHEM 313: CHEMICAL KINETICS

STREAMS: BEd (Sc) & BSc (Gen)

TIME: 2 HRS

DAY: MONDAY [11.30 – 13.30 P.M]

DATE: 26/01/2026

THIS QUESTION PAPER CONSISTS OF THREE (3) PAGES

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INSTRUCTIONS: Answer **All** Questions

QUESTION ONE (30 MARKS)

a) Define the following terms

- | | |
|--------------------------------|----------|
| i) Order of a reaction | (1 Mark) |
| ii) Elementary reaction | (1 Mark) |
| iii) complex reaction | (1 Mark) |
| iv) molecularity of a reaction | (1 Mark) |

b) State the differences between Order and Molecularity of a reaction (4 Marks)

c) i) Define rate of a reaction (1 Mark)

ii) The concentration of CO was found experimentally every 10 seconds. The results are show below

Time (sec)	0	10	20	30	40
Conc. of CO	0.100	0.067	0.050	0.040	0.033

Calculate average rate of reaction I) Over the first 10 seconds and II) between 30 and 40 seconds (4 Marks)

d) i) What is meant by half-life of a chemical reaction? (1 Mark)

ii) For a certain first order reaction $t_{0.5}$ is 100 sec. How long will it take for the reaction to be completed 75%? (3 Marks)

e) Explain the following giving illustrations:

- | | |
|----------------------------|-----------|
| (i) Parallel Reactions | (2 Marks) |
| (ii) Reversible Reactions | (2 Marks) |
| (ii) Consecutive Reactions | (2 Marks) |

f) Define the following:

- | | |
|------------------------|----------|
| (i) Catalyst | (1 Mark) |
| (ii) Catalyst promoter | (1 Mark) |
| (iii) Autocatalysis | (1 Mark) |

g) Give the general characteristics of catalytic reactions. (4 Marks)

QUESTION TWO (20 MARKS)

a) Briefly explain the collision theory of reaction rates. State and explain its limitations?

(8 Marks)

- b) i) State the effect of temperature on the reaction rate and explain the term temperature coefficient
(2 Marks)
- ii) A $\ln k$ versus $1/T$ graph was plotted to calculate the activation energy of a reaction using Arrhenius equation of the effect of temperature on reaction rate. The slope of the straight line was found to be $-2.55 \times 10^4 \text{K}$. Calculate the activation energy of the reaction.
($R = 8.314 \text{JK}^{-1}\text{mol}^{-1}$) (2 Marks)
- c) Discuss the two theories of catalysis. (6 Marks)
- d) Explain the mechanism of enzyme catalysis (2 Marks)

QUESTION THREE (20 MARKS)

- a) i) Give a summary of the transition state theory of reaction rates highlighting how it has overcome the limitations of the collision theory (4 Marks)
- ii) Illustrate the activated complex theory using a potential energy diagram for an endothermic reaction
 $A + B - C \rightarrow A - B + C$ (3 Marks)
- b) i) Define the term rate law (1 Mark)
- ii) Given the data below, find the rate law and order for the following reaction at 300K.
 $A + B \rightarrow C + D$

Trial	$[A]_{\text{initial}} \text{ (M)}$	$[B]_{\text{initial}} \text{ (M)}$	$r_{\text{initial}} \text{ (M/sec)}$
1	0.10	0.10	4.0×10^{-4}
2	0.10	0.20	1.6×10^{-3}
3	0.20	0.10	8.0×10^{-4}

- (4 Marks)
- c) Using the integrated rate laws, state the units for zero, first and second order reactions (3 Marks)
- d) Briefly give an account of;
- (i) Catalyst and energy of activation (3 Marks)
- (ii) Specificity of catalytic action (2 Marks)