

**ELIDASA LEARN – ADVANCED CHEMISTRY**  
**FORM SIX TOPICAL TEST**  
**CHEMISTRY (ELECTROCHEMISTRY & CHEMICAL KINETICS)**

**TIME: 3 Hours**  
**Date: November, 2025**

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**Instructions:**

1. This paper consists of **ten (10)** questions.
2. Answer **all questions**.
3. Show all your working clearly where necessary.
4. Write your **examination number** on every page.
5. You may use the following constants:

Faraday Constant,  $F = 96500 \text{ C mol}^{-1}$

Gas Constant,  $R = 8.31 \text{ J mol}^{-1} \text{ K}^{-1}$

1 Faraday = 96500 Coulombs

**ELECTROCHEMISTRY SECTION**

**1.**

(a) Define the following terms:

- (i) Oxidation
- (ii) Reduction
- (iii) Standard electrode potential [3 marks]

(b) Write the conventional cell representation and overall cell reaction for a galvanic cell formed by  **$\text{Cu}^{2+}/\text{Cu}$**  and  **$\text{Zn}^{2+}/\text{Zn}$**  half-cells. [4 marks]

(c) Calculate the EMF of the cell using the data below:

$$E_{\text{Cu}^{2+}/\text{Cu}}^{\circ} = +0.34\text{V}, E_{\text{Zn}^{2+}/\text{Zn}}^{\circ} = -0.76\text{V}$$

[3 marks]

2.

(a) Explain the difference between **electrolytic** and **galvanic** cells in terms of energy change and electrode polarity. [3 marks]

(b) During electrolysis of aqueous copper(II) sulfate using copper electrodes:

(i) Identify the products formed at both electrodes.

(ii) Write the half equations.

(iii) Explain why the blue color of the solution remains unchanged. [5 marks]

(c) Sketch a well-labeled diagram of the apparatus used in this electrolysis. [2 marks]

3.

(a) State **Faraday's First and Second Laws of Electrolysis**. [2 marks]

(b) 0.54 g of silver was deposited during the electrolysis of silver nitrate solution using a current of 2 A. Calculate the time required.

(Relative atomic mass of Ag = 108) [4 marks]

(c) State two experimental sources of error that can affect the accuracy of such an electrolysis experiment. [4 marks]

4.

(a) Write the **Nernst equation** and explain the meaning of each term. [3 marks]

(b) The potential of a copper electrode in a  $\text{Cu}^{2+}$  solution is +0.25 V at 25°C.

Calculate the concentration of  $\text{Cu}^{2+}$  ions if the standard electrode potential is +0.34 V. [5 marks]

(c) Explain why electrode potential depends on **temperature** and **concentration**. [2 marks]

5.

(a) Explain how **electrochemical series** is useful in:

(i) Predicting feasibility of redox reactions

(ii) Metal extraction

(iii) Electroplating [6 marks]

(b) Suggest the **anode and cathode reactions** when an iron spoon is electroplated with silver. [4 marks]

## CHEMICAL KINETICS SECTION

6.

(a) Define the following terms:

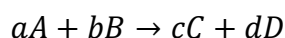
- (i) Rate of reaction
- (ii) Activation energy
- (iii) Catalyst [3 marks]

(b) State three factors that affect the rate of a chemical reaction and explain how each influences the rate. [6 marks]

(c) Draw a labeled energy profile diagram for a catalyzed and uncatalyzed reaction. [1 mark]

7.

(a) Write the general rate law expression for a reaction:



and explain the meaning of each term. [3 marks]

(b) The rate of a reaction between A and B was found to obey the rate equation:

$$\text{Rate} = k[A]^2[B]$$

If the concentration of A is doubled while B remains constant, by what factor does the rate change? [3 marks]

(c) The rate constant,  $k$ , of a reaction double when temperature increases from 300 K to 310 K. Calculate the activation energy of the reaction ( $R = 8.31 \text{ Jmol}^{-1}\text{K}^{-1}$ ). [4 marks]

8.

(a) Define **order of reaction** and **molecularity of a reaction**. [2 marks]

(b) Explain two differences between the two. [2 marks]

(c) The decomposition of  $\text{N}_2\text{O}_5$  follows the first-order kinetics.

Given that 50% decomposes in 30 minutes, calculate the rate constant and the time required for 75% decomposition. [6 marks]

9.

(a) Explain how temperature affects the rate of a reaction using the **collision theory**.  
[4 marks]

(b) Describe how a catalyst affects:

(i) Activation energy

(ii) Rate of reaction [2 marks]

(c) The following data were obtained for a reaction:

| [A] (mol dm <sup>-3</sup> ) | [B] (mol dm <sup>-3</sup> ) | Rate (mol dm <sup>-3</sup> s <sup>-1</sup> ) |
|-----------------------------|-----------------------------|----------------------------------------------|
| 0.1                         | 0.1                         | $2.0 \times 10^{-5}$                         |
| 0.2                         | 0.1                         | $8.0 \times 10^{-5}$                         |
| 0.1                         | 0.2                         | $4.0 \times 10^{-5}$                         |

Determine the **order of reaction** with respect to A and B. [4 marks]

10.

(a) Differentiate between **instantaneous** and **average rate of reaction**. [2 marks]

(b) Explain how you would determine the order of reaction experimentally using the **initial rates method**. [4 marks]

(c) Sketch and label a graph showing how **concentration of reactant** changes with time for a **first-order reaction**. [4 marks]

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**THE END**

*Nothing is permanent*