Table ST1. List of test queries passed to the model

Query ID	Query	Expectation from the Model	Query Type
Q0	What is cyclic Voltammetry?	A definition and basic explanation of cyclic voltammetry (CV), a fundamental electrochemical technique. It expects a concise overview of the method's principles and purpose.	Simple
Q1	What is chronoamperometry?	Similar to the previous query, this one aim to understand chronoamperometry. The model should provide a definition and a brief description of this electrochemical technique.	
Q2	Explain the principles of chronocoulometry.	A deeper dive into chronocoulometry, focusing on the underlying principles that govern this technique. The model should explain the theoretical basis and how the method works.	
Q3	What is the formula for Randles-Sevcik Equation?	A specific request for the Randles-Sevcik equation, a crucial formula in electrochemistry, particularly in cyclic voltammetry. The model should present the equation accurately.	
Q4	What is Linear Sweep Voltammetry?	An explanation of linear sweep voltammetry (LSV), another essential electrochemical technique. The model should provide a definition and a brief overview of the method.	
Q5	What is Anodic Stripping Voltammetry?	Similar to the previous queries, this one focuses on anodic stripping voltammetry (ASV). The model should provide a definition and a concise description of this technique.	
Q6	What are the different types of working electrodes?	A categorization of working electrodes used in electrochemistry. The model should list and briefly describe the various types of working electrodes commonly employed in experiments.	
Q7	How to polish the glassy carbon electrode?	Practical guidance on electrode preparation. The model should provide instructions or steps on how to properly polish a glassy carbon electrode, a common type of working electrode.	
Q8	How to keep the electrodes active?	Advice on electrode maintenance. The model should provide tips or recommendations on how to ensure the continued activity and effectiveness of electrodes over time.	
Q9	What are coupled reactions?	Seeking a definition and explanation of a chemical concept, with the expectation that the model understands the context in electrochemistry	

CQ0	Discuss the advantages and limitations of using chronoamperometry versus chronocoulometry for studying adsorption processes at an electrode surface.	A comparative analysis of two electrochemical techniques (chronoamperometry and chronocoulometry) specifically in the context of studying adsorption processes on electrodes. It expects the model to highlight the strengths and weaknesses of each technique for this particular application.	Complex
CQ1	Explain how the peak current in cyclic voltammetry is affected by the scan rate and the concentration of the analyte, and derive the Randles-Sevcik equation.	An explanation of the fundamental relationship between peak current, scan rate, and analyte concentration in cyclic voltammetry. It also requires the model to demonstrate its understanding by deriving the Randles-Sevcik equation, a key formula in this electrochemical technique.	
CQ2	Describe the different types of working electrodes commonly used in electroanalytical chemistry, highlighting their specific properties and applications, and explain the significance of electrode polishing.	A comprehensive overview of working electrodes in electroanalytical chemistry. The model should categorize different types, describe their unique properties and typical uses, and explain the importance of electrode polishing for optimal performance.	
CQ3	In anodic stripping voltammetry, explain the role of the deposition step and how it influences the sensitivity and selectivity of the technique for trace metal analysis.	A focused explanation of a crucial step in anodic stripping voltammetry (the deposition step). The model should detail how this step impacts the technique's ability to detect and quantify trace metals with high sensitivity and selectivity.	
CQ4	Compare and contrast linear sweep voltammetry and cyclic voltammetry, emphasizing the information that can be obtained from each technique and their respective advantages and limitations.	A comparative analysis of two related voltammetric techniques (linear sweep voltammetry and cyclic voltammetry). The model should highlight the type of information each technique provides, along with their respective strengths and weaknesses in experimental applications.	
CQ5	Explain how coupled chemical reactions can influence the shape and characteristics of cyclic voltammograms, providing examples of different types of coupled reactions (e.g., EC, CE).	An understanding of how chemical reactions that occur alongside electron transfer (coupled reactions) can alter the typical shape and features of cyclic voltammograms. The model should illustrate this with examples of common coupled reaction types (e.g., EC, CE).	
CQ6	Discuss the factors that affect the reversibility of an electrochemical reaction, and how they can be	Insight into the concept of electrochemical reaction reversibility. The model should identify factors influencing reversibility and explain how cyclic voltammetry can be	

	determined using cyclic voltammetry.	employed to assess the reversibility of a reaction.	
CQ7	Describe the principles of electrochemical impedance spectroscopy (EIS) and its applications in studying electrode processes and material properties.	A foundational explanation of electrochemical impedance spectroscopy (EIS). The model should outline the basic principles of this technique and describe its common applications in investigating electrode processes and material characteristics.	
CQ8	Explain the concept of electrocatalysis and how it can be used to enhance the rate of electrochemical reactions, providing examples of electrocatalysts and their applications.	An understanding of electrocatalysis and its role in accelerating electrochemical reactions. The model should explain the underlying concept, provide examples of electrocatalysts, and discuss their practical applications.	
CQ9	Discuss the challenges and opportunities in developing new electrochemical sensors for environmental monitoring and biomedical applications.	A broader perspective on the field of electrochemical sensors. The model should address the current challenges and future opportunities in designing and implementing new sensors for applications in environmental monitoring and biomedical fields.	

Table ST2: Retrieval Performance Metrics

Query ID	Manually Identified Relevant Documents in Order	Automatically Identified Relevant Document IDs in order	Retrieved Document IDs using Chroma DB in order	Retrieved Document IDs using TF-IDF in order	Retrieved Document IDs using BM25 in order	Accuracy			Precision			Recall			F1-Score		
						ChromaDB	TF-IDF	BM25	ChromaDB	TF-IDF	BM25	Chroma DB	TF-IDF	BM25	Chroma DB	TF-IDF	BM25
Q0	3,1,4,5	3, 1, 4, 5	3,4,1,5,9	3,9,1,4,8	3,1,4,5,0	1	0.75	1	0.8	0.6	0.8	1	0.75	1	0.89	0.67	0.89
Q1	2	2	2,7,4,9,3	2,7,9,8,6	2,7,0,8,1	1	1	1	0.2	0.2	0.2	1	1	1	0.33	0.33	0.33
Q2	7	7	7,2,4,5,1	7,1,6,3,9	7,0,1,2,3	1	1	1	0.2	0.2	0.2	1	1	1	0.33	0.33	0.33
Q3	6,1	6,1	6,1,4,7,2	6,1,2,7,4	0,1,2,3,4	1	1	0.5	0.4	0.4	0.2	1	1	0.5	0.58	0.57	0.29
Q4	6	6	9,6,3,4,1	9,3,6,0,8	3,1,4,9,5	1	1	0	0.2	0.2	0	1	1	0	0.33	0.33	0
Q5	9	9	9,3,7,6,4	9,0,3,5,8	9,0,5,3,1	1	1	1	0.2	0.2	0.2	1	1	1	0.33	0.33	0.33
Q6	0	0	0,8,4,9,3	9,0,3,5,8	0,8,4,1,7	1	1	1	0.2	0	0.2	1	1	1	0.33	0.33	0.33
Q7	8	2,8,0	8,0,9,4,6	8,0,2,4,6	8,0,9,2,4	0.67	1	1	0.4	0.6	0.6	0.67	1	1	0.5	0.75	0.75
Q8	8	0	8,0,4,2,6	8,0,4,6,2	8,0,4,1,2	1	1	1	0.2	0.2	0.2	1	1	1	0.33	0.33	0.33
Q9	5	5	5,2,6,7,3	8,7,5,0,1	7,5,0,1,2	1	1	1	0.2	0.2	0.2	1	1	1	0.33	0.33	0.33
CQ0	2,7	2,7,0,8	7,2,4,8,9	0,7,8,2,6	0,7,8,2,9	0.6	0.8	0.8	0.6	0.8	0.8	0.6	0.8	0.8	0.6	0.8	0.8
CQ1	3,1,6	3,1,4,5,2	1,6,4,5,3	1,3,4,6,2	1,5,4,9,3	0.56	0.56	0.56	1	1	1	0.56	0.56	0.56	0.71	0.71	0.71
CQ2	0,8	2,0,8	0,8,9,4,7	8,0,1,4,3	8,0,4,1,9	0.5	0.5	0.5	0.4	0.4	0.4	0.5	0.5	0.5	0.44	0.44	0.44
CQ3	9	9	9,8,7,2,6	9,1,7,3,2	9,0,8,5,7	1	1	1	0.2	0.2	0.2	1	1	1	0.33	0.33	0.33
CQ4	3,1,4,6	3,1,4,5,6	3,4,9,1,6	3,0,8,4,1	0,2,9,1,4	0.8	0.5	0.5	1	0.6	0.6	0.8	0.5	0.5	0.91	0.55	0.55

CQ5	3,1,4,5	3,1,4,5,2	5,3,4,1,2	1,0,3,8,6	0,1,5,7,8	0.71	0.43	0.43	1	0.6	0.6	0.71	0.43	0.43	0.83	0.5	0.5
CQ6	3,1,4	3,1,4,5,2	3,1,4,5,2	3,1,8,4,0	0,8,1,5,3	1	0.6	0.6	1	0.6	0.6	1	0.6	0.6	1	0.6	0.6
CQ7	-	2,0,8	4,0,8,1,9	0,8,3,1,4	8,5,0,2,4	0.5	0.5	0.75	0.4	0.4	0.6	0.5	0.5	0.75	0.44	0.44	0.67
CQ8	-	2	8,5,0,2,7	1,8,0,6,3	0,8,1,9,4	1	0	0	0.2	0	0	1	0	0	0.33	0	0
CQ9	-	2	0,8,9,4,2	8,0,3,4,1	8,0,1,5,9	1	0	0	0.2	0	0	1	0	0	0.33	0	0

Table ST3. Average Manual evaluation scores

Query ID	Accuracy			Relevance			Fluency and Coherence			Overall Quality		
	Correctness	Completeness	Precision	Question Alignment	Information Need	Contextual Appropriateness	Grammaticality	Clarity	Logical Flow	Helpfulness	Satisfaction	Trustworthiness
Q0	5	5	4.5	4.5	4.5	4	5	4.5	4.5	4.5	4.5	5
Q1	5	5	5	5	5	5	5	5	5	5	5	5
Q2	4.5	4.5	4	3.5	4.5	4.5	5	4.5	4	4	4	4
Q3	5	5	5	4.5	4	4.5	5	4.5	4.5	4.5	4	4.5
Q4	4	4	4	4	3.5	4	5	5	5	4	4	4.5
Q5	5	5	5	4.5	4.5	4.5	4.5	4.5	5	4.5	4.5	4.5
Q6	4.5	4.5	4.5	5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Q7	5	5	5	5	5	5	4.5	5	5	5	5	5
Q8	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
Q9	4.5	4	4	4	4	4	4	4	4	4	4	4
CQ0	5	5	5	5	5	5	5	5	5	5	5	5
CQ1	3	3	3	2.5	2.5	2.5	4.5	4.5	4.5	3	3	3.5
CQ2	2	2	2	2	2	2	3	3	3	2.5	2.5	2.5
CQ3	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
CQ4	4.5	4.5	4.5	4.5	4.5	4.5	3.5	4.5	4.5	4.5	4.5	4.5
CQ5	5	5	5	5	5	5	5	5	5	5	5	5
CQ6	4.5	4.5	4.5	4.5	4.5	4.5	3.5	4.5	4.5	4.5	4	4.5

CQ7	2.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5
CQ8	2.5	3.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	3.5	4.5
CQ9	2.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5	4.5