Wee Waa High School

Assessment Task Notification

FACULTY: Science / TAS

Student Name: _____ **Class:** **12 Chemistry**

Title: Task One – Skills – Determination of Keq by colorimetry.		
Assessment Task Number: 1	**Course: Chemistry**	**Weighting: 35%**
Teacher/s:	Mr S Catt	**Issue Date: 18/11/24**
Type:	Practical	**Due Date: 05/12/24**
Allocated Lessons:	4 lessons	**Time: 15:10**

Syllabus outcomes being assessed:

A student:

CH11/12-3 conducts investigations to collect valid and reliable primary and secondary data and information

CH11/12-5 analyses and evaluates primary and secondary data and information

CH11/12-7 communicates scientific understanding using suitable language and terminology for a specific audience or purpose

CH12-12 explains the characteristics of equilibrium systems, and the factors that affect these systems

Assessment Presentation Guidelines

- **This notification must be attached to the task when submitted.**
- **Handwritten or submitted on teams**

Task Description:

You will be completing a practical on the Determination of Keq by colorimetry, analysing the results and competing an experimental report.

A copy of the experiment is attached.
The experiment will be done on Wednesday the 19th of November.

Declaration of Authenticity

I certify that:

- **The planning, development, content and presentation of this assessment task is my own work in every respect**
- **This assessment task has not been copied from another person's work or from books or the internet or any other source**
- **I have used appropriate research methods and have not used the words, ideas, designs, music, images, skills or workmanship of others without appropriate acknowledgement in this assessment task or in its development**

_____ _____

Student Signature **Date**

Feedback

Feedback will be given to students in the following ways

- **Via Teams**
- **Verbally**
- **On this sheet.**

Determination of K_{eq} by colorimetry

INTRODUCTION

In aqueous solution, Fe^{3+} ions react with SCW ions to form the blood-red coloured $FeSCN^{2+}$ ion. The equilibrium is represented by the equation:

$$Fe^{3+}(aq) + SCW(aq) \rightleftharpoons FeSCN^{2+}(aq)$$

The colour of the solution is directly proportional to the concentration of $FeSCN^{2+}$ ions present.

Later in the year, in Module 8, you will learn about the analytical technique called colorimetry. This spectroscopic technique is used to determine the concentration of coloured species in an aqueous sample. The absorption of light energy causes electrons in ions or molecules to jump from a lower energy level to a higher one.
The amount of light energy absorbed is directly proportional to the concentration of the coloured species.

In this experiment you will use a colorimeter to measure the absorbance of a standard solution with a known concentration of $FeSCN^{2+}$. The concentration of $FeSCN^{2+}$ ions in other equilibrium mixtures can then be found by measuring their absorbance and comparing the absorbance with the absorbance of the standard. Knowing the initial concentration of Fe^{3+} and SCW in each mixture, the equilibrium concentration of Fe^{3+} and SCN- can be calculated and a value for the equilibrium constant, K_{eq}, tor the reaction can be determined.

AIM

To determine the value of the equilibrium constant for the equilibrium system involving Fe^{3}+ ions, SCW ions and $FeSCN^{2+}$ ions by colorimetric analysis.

Material	Hazard	Control
KSCN solution	irritating to the skin and eyes	Wear *gloves,* lab coat, safety glasses.
$FeSCN^{2+}$ solution	contains nitric acid and is irritating to the skin and eyes	Wear *gloves,* lab coat, safety glasses.
$Fe(NO_3)_2$ solution	irritating to eyes, respiratory system and skin	Wear gloves, lab coat and safety glasses.

Method

1 Label four test-tubes A to D.

2 Using a graduated pipette, place volumes of 0.0020 mol L^{-1} $Fe(NO_3)_3$ solution, 0.0020 mol L^{-1} KSCN solution and water into each test-tube as indicated in the table below. Mix each solution thoroughly with a stirring rod. Be careful to clean and dry the stirring rod after each mixing.

Test-tube	$Fe(NO_3)_2$ (aq) (ml)	KSCN (aq) (ml)	H_2O (ml)
A	5.0	2.0	3.0
8	5.0	3.0	2.0
C	5.0	4.0	1.0
D	5.0	5.0	0.0

3 Prepare a reference cell or 'blank' by filling the colorimeter cell to three-quarters of its volume with deionised water. Wipe the outside of the cell with a tissue. By following the manufacturer's instructions, calibrate the colorimeter to read zero transmittance when no light passes through the cell and 100% transmittance when blue light (470 nm) passes through the blank. Use blue light for the remainder of this experiment.

4 Discard the deionised water from the cell, rinse the cell twice with the standard 0.00020 mol L^{-1} $FeSCN^{2+}$ solution and fill the cell to three-quarters of its volume. Measure the absorbance and record the results in the Results table.

5 Repeat the procedure in step 4 to measure the absorbance of the solutions in each of test-tubes A-D.

RESULTS

Solution	Absorbance
$FeSCN^{2+}$	
test-tube A	
test-tube B	
test-tube C	
test-tube D	

DISCUSSION

1 Write an expression for the equilibrium law for the reaction.

2 Use the following table to enter the results of the calculations in questions **3-8** below.

	Test-tube			
	A	**B**	**C**	**D**
$[Fe^{3+}]_{initial}$				
$[SCN^{-}]_{initial}$				
$[FeSCN^{2+}]_{equilibrium}$				
$[Fe^{3+}]_{equilibrium}$				
$[SCN^{-}]_{equilibrium}$				
K_{eq}				

3 Calculate the initial concentration of Fe^{3+} in each of the test-tubes A-D and fill it in the appropriate space in the table. The $[Fe^{3+}]$ in each tube is given by the expression:

$$[Fe^{3+}]_{initial} = \frac{0.0020 \times \text{volume of } Fe(NO_3)_3 \text{ in the tube in mL}}{\text{total volume in mL}}$$

4 Calculate the initial concentration of SCW in each of test-tubes A-D and put this in the table. [SCW] in each tube is given by the expression:

$$[SCN^-]_{initial} = \frac{0.0020 \times \text{volume of KSCN in the tube in mL}}{\text{total volume in mL}}$$

5 The absorbance of light by a solution is directly proportional to the concentration of the absorbing chemical in solution. As a result, you can calculate the concentration of $FeSCN^{2+}$ at equilibrium in each test-tube by comparing the absorbance of each solution with the absorbance of the standard solution.

$$[FeSCN^{2-}]_{equilibrium} = 0.00020 \times \frac{\text{absorbance of solution}}{\text{absorbance of standard}}$$

6 Calculate the $[Fe^{3+}]_{equilibrium}$ in each of the tubes:

$$[Fe^{3+}]_{equilibrium} = [Fe^{3+}]_{initial} - [FeSCN^{2+}]_{equilibrium}$$

7 Calculate the $[SCN^-]_{equilibrium}$ in each of the tubes:

$$[SCN^-]_{equilibrium} = [SCN^-]_{initial} - [FeSCN^{2+}]_{equilibrium}$$

8 Using the equilibrium law from question 1, calculate a value for the equilibrium constant, K_{eq}, for each set of data.

9 Calculate an average value for K_{eq}. Comment on the reliability and accuracy of K_{eq} determined from each set of data.

CONCLUSION:

Write a suitable conclusion that reflects the aim.

Marking Criteria:			
LAB WORK			
Lab Work **CH11/12-3**	Marks are deducted for unsafe practices	**10**	**/10**
REPORT			
Aim **CH11/12-7**	Written in suitable scientific language	**2**	**/2**
	Written not in suitable scientific language	**1**	
Method **CH11/12-7**	Written in suitable scientific language	**2**	**/2**
	Written not in suitable scientific language	**1**	
Results **CH11/12-3** **CH11/12-7**	In a table or tables	**1**	**/5**
	Is ruled	**1**	
	Is correctly labelled	**1**	
	Has Units	**1**	
	Results are accurate and reliable	**1**	
Discussion: 1 **CH12-12**	Keq expression is correct	**2**	**/2**
	Keq expression contains errors	**1**	
Discussion: 2 **CH11/12-7**	In a table or tables	**1**	**/5**
	Is ruled	**1**	
	Is correctly labelled	**1**	
	Has Units	**1**	
	Has all the data	**1**	
Discussion: 3 **CH12-12** **CH11/12-5**	Calculates $[Fe^{3+}]_{initial}$ correctly	**4**	**/4**
	Calculates $[Fe^{3+}]_{initial}$ with one error	**3**	
	Calculates $[Fe^{3+}]_{initial}$ with two errors	**2**	
	Calculates $[Fe^{3+}]_{initial}$ with more than three errors	**1**	

Discussion: 4 **CH12-12** **CH11/12-5**	Calculates $[SCN^-]$ initial correctly	4	/4
	Calculates $[SCN^-]$ initial with one error	3	
	Calculates $[SCN^-]$ initial with two errors	2	
	Calculates $[SCN^-]$ initial with more than three errors	1	
Discussion: 5 **CH12-12** **CH11/12-5**	Calculates $[FeSCN^{2+}]$ equilibrium correctly	4	/4
	Calculates $[FeSCN^{2+}]$ equilibrium with one error	3	
	Calculates $[FeSCN^{2+}]$ equilibrium with two errors	2	
	Calculates $[FeSCN^{2+}]$ equilibrium with more than three errors	1	
Discussion: 6 **CH12-12** **CH11/12-5**	Calculates $[Fe^{3+}]$ equilibrium correctly	4	/4
	Calculates $[Fe^{3+}]$ equilibrium with one error	3	
	Calculates $[Fe^{3+}]$ equilibrium with two errors	2	
	Calculates $[Fe^{3+}]$ equilibrium with more than three errors	1	
Discussion: 7 **CH12-12** **CH11/12-5**	Calculates $[Fe^{3+}]$ equilibrium correctly	2	/4
	Calculates $[Fe^{3+}]$ equilibrium with one error		
	Calculates $[Fe^{3+}]$ equilibrium with two errors		
	Calculates $[Fe^{3+}]$ equilibrium with more than three errors	1	
Discussion: 8 **CH12-12** **CH11/12-5**	Calculates the K_{eq} for sample A correctly	1	/4
	Calculates the K_{eq} for sample B correctly	1	
	Calculates the K_{eq} for sample C correctly	1	
	Calculates the K_{eq} for sample D correctly	1	
Discussion: 9 **CH12-12** **CH11/12-5**	Averages Keq Correctly	2	/2
	Averages Keq with errors	1	
Conclusion **CH11/12-7**	Completed	1	/3
	Reflects the aim	1	
	Written in 3rd person	1	
		TOTAL	/55
		TASK RANK	/3
		CUMULATIVE RANK	.3

Teacher Feedback: