

NAME: _____

COMBN: _____

AHSN

S.6 TOPICAL TEST 1 TERM II 2023

ELECTROCHEMISTRY

1 hour 45 minutes

Instructions

Attempt all questions

1. (a) Define the term molar conductivity. (01 mark)

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- (b) (i) Sketch a graph to show the variation of molar conductivity of sodium chloride with dilution.

(02 marks)

- (ii) Explain the shape of the graph in (b)(i).

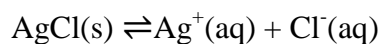
(2½ marks)

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- (c) The electrolytic conductivity of saturated solution of silver chloride at 25⁰C is $1.5 \times 10^{-4} \text{ }^{-1}\text{m}^{-1}$. The molar conductivities at infinite dilution of silver and chloride ions are 6.2×10^{-3} and $7.7 \times 10^{-3} \text{ }^{-1}\text{m}^{-1}\text{mol}^{-1}$ respectively. Determine the solubility of silver chloride at 25⁰C. (3½ marks)

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2. (a) Silver chloride dissolves in water according to the following equation:



Write the expression for the solubility product K_{sp} of silver chloride. (01 mark)

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(b) The electrolysis conductivity of a saturated solution of silver chloride in water at 25°C is $3.41 \times 10^{-6} \text{ } \Omega^{-1}\text{cm}^{-1}$ and that of pure water is $1.6 \times 10^{-6} \text{ } \Omega^{-1}\text{cm}^{-1}$. Calculate the solubility product of a saturated solution of silver chloride at 25°C. (The molar conductivity at infinite dilution of silver nitrate, Potassium nitrate and potassium chloride are 133.4, 145.0 and $149.9 \text{ } \Omega^{-1}\text{cm}^{-1}\text{mol}^{-1}$ respectively at 25°C. (4½ marks)

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3. (a) Write

(i) Equation for the ionization of methanoic acid in water. (1½ marks)

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(ii) The expression for the acid dissociation constant K_a , for methanoic acid. (1 mark)

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(b) The molar conductivities of some electrolytes at infinite dilution at 25°C are given in the table below:

Electrolyte	Molar conductivity at infinite dilution ($\text{Scm}^2\text{mol}^{-1}$)
Sodium chloride	113.0
Sodium methanoate	101.0
Sodium hydroxide	252.2
Hydrochloric acid	397.8

Calculate the molar conductivity of methanoic acid at infinite dilution. (03 marks)

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- (c) The molar conductivity of a 0.05M methanoic acid solution is $24.318 \text{ S cm}^2 \text{ mol}^{-1}$ at 25°C .

Calculate

- (i) Degree of ionization of methanoic acid at 25°C (1½ marks)

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- (ii) Dissociation constant, K_a of methanoic acid at 25°C . (02 marks)

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4. The table below shows the atomic radius and the first ionization energy of some elements in period (III) of the periodic table.

Element	Mg	Ca	Sr	Ba
Standard electrode potential $E^\circ(\text{V})$	-2.37	-2.87	-2.89	-2.91

- (a) (i) Identify the element which is the most powerful reducing agent. (1 mark)

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- (ii) Give a reason for your answer in (a)(i) (1½ marks)

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- (b) (i) State the trend in standard electrode potential of the elements? (1 mark)

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- (ii) Explain your answer in (b) (i) (2 marks)

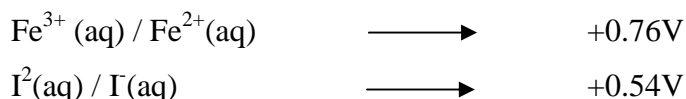
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5. What is meant by the term: The standard electrode potential for some half cells are shown below



- (a) Write

(i) the cell convention for the combined cell. (1 mark)

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(ii) the equation for the overall cell reaction (1½ mark)

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(b) Calculate the overall electrode potential for the cell. (1½ marks)

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(c) (i) State whether the reaction is feasible or not (½ mark)

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(ii) Give a reason for your answer. (½ mark)

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6. (a) (i) Define **standard electrode potential**. (02 marks)

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(ii) Why is it not possible to measure standard electrode potential absolutely? (02 marks)

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(iii) Discuss the factors which affect the value of standard electrode potential. (5½ marks)

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END.