ELECTROCHEMISTRY 1 hour 45 minutes Instructions Attempt all questions (a) Define the term molar conductivity. Fig. served stances, of son agence, solution, containing, one mole has an electrolyte process sectional area. (b) (i) Sketch a graph to show the variation of molar conductivity of sodium chloride with dilution. (02 marks) Malar, conductivity in increases, with increase in dilution, and reaches, a solution of and conductivity. At infinite, dilution, increases, with increase in dilution makes, the least for and increases, in a solution of silver chloride at 25°C. (c) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (d) The electrolytic conductivity of saturated solution of silver chloride ins are 6.2 x 10°3 and 7.7 x 10°3 Ω°m mol respectively. Determine the solubility of silver chloride at 25°C. (e) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (f) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (g) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (h) In the increase in the solubility of silver chloride at 25°C. (h) In the electrolytic conductivity of saturated solution of silver chloride at 25°C. (e) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (f) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (g) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (h) In the electrolytic conductivity of saturated solution of silver chloride at 25°C. (h) In the electrolytic conductivity of saturated solution of silver chloride at 25°C. (h) In the electrolytic conductivity of saturated solution of silver chloride at 25°C. (h) In the electrolytic conductivity of saturated solution of silver chloride at 25°C. (h) In the electrolytic conductivity of saturated solution of silver chloride at 25°C. (h) In the electrolytic conductivity of saturated solution of silver chloride at 25°C	NAME:	21/06/23. COMBN	
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(ii) Explain the shape of the graph in (b)(i). (iii) Explain the shape of the graph in (b)(i). (iii) Explain the shape of the graph in (b)(i). (iii) Explain the shape of the graph in (b)(i). (iii) Explain the shape of the graph in (b)(i). (iv) Malar conductivity increases with increase in allution and reaches a content of a cinfinite dilution. This is because increase in allution and reaches a content of and ionic interference is reduced bence the mobility of the lass increases. In therefore, in reduced thints. At infinite dilution, ionic interference has been eliminated and some for the dilution. Tesults into no charge in malar conductivity. (c) The electrolytic conductivity of saturated solution of silver chloride at 25°C is 1.5 x 10 ⁴ Ω ⁻¹ m ⁻¹ . The molar conductivities at infinite dilution of silver and chloride ions are 6.2 x 10 ⁻³ and 7.7 x 10 ⁻³ Ω ⁻¹ m ⁻¹ mol ⁻¹ respectively. Determine the solubility of silver chloride at 25°C. (a) Ag(1) = 1.6.2 x 10 ⁻³ + 7.7 x 10 ⁻³ (b) (i) Sketch a graph to show the variation of molar conductivity. (c) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (c) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (c) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (c) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (c) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (c) The electrolytic conductivity of saturated solution of silver chloride at 25°C. (c) The electrolytic conductivity of saturated solution of silver chloride at 25°C.			(UI mark)
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= 1.39×10 2 mmol 1	1 mol $^{-1}$ respectively. Determine $-\frac{1}{2}$	the solubility of silver chloride at 25° C. $+ \mathcal{L}_{\circ}Cl^{-}$	32.
= 1.39×10 2 mmol 1	= 6.2×10	53 + 7.7×103 -	
1000 No = 1.51×16,4	= 1.39×1	o 2 mmol	
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1000×1.39×10	Lo 21000		
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(a) Silver chloride dissolves in water according to the following equation: AgCl(s) ⇒ Ag* (aq) + Cl'(aq) Write the expression for the solubility product ksp of silver chloride. (b) The electrolytis conductivity of a saturated solution of silver chloride in water at 25°C is 3.41 × 10 ⁴ Ω¹cm¹ and that of pure water is 1.6 × 10 ⁶ Ω¹cm¹. 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 Ω¹·cm²mol⁻¹ respectively a 25°C. ΛοΛg(1 = ΛοΛηθο3 + ΛοΚο1 - ΛοΚΝο3 + ΛοΚο1 - ΛοΚΝο3 + ΛοΚο1 - ΛοΚΝο3 + ΛοΛηθο1 - 1.83 · 3 · 3 · 1.81 · 1.9 · 3 · 1.45 · 0 · 1.9 · 1.81 · 1.9 · 1.			
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(a) Write (i) Equation for the ionization of methanoic acid in water. (ii) The expression for the acid dissociation constant ka, for methanoic acid. (ii) The molar conductivities of some electrolytes at infinite dilution at 25°C are given in the table below: (b) The molar conductivities of some electrolytes at infinite dilution at 25°C are given in the table sodium methanoate Sodium methanoate Sodium hydroxide Hydrochloric acid Calculate the molar conductivity of methanoic acid at infinite dilution. (03 marks) Hologophy			
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(i) Equation for the ionization of methanoic acid in water. HCOOH (1) HTOO HTOO HTOO HTOO HTOO HTOO HTOO HTO			3- 111. KM
HCOOH (12) HCOO (13) HCOO (13) HCOO (13) HCOO (13) HCOOH (14) HCOO (15) HCOOH		ethanoic acid in water	(1½ marks)
(ii) The expression for the acid dissociation constant ka, for methanoic acid. (1 mark) \[\lambda = \int \text{Hcool} \cdot \frac{1}{1} \\ \text{Lcool} \\ \text{Lcool} \cdot \frac{1}{1} \\ \text{Lcool} \cdot	(1) Equation for the formation of the	1+cm + HCOO	
(ii) The expression for the acid dissociation constant ka, for methanoic acid. (1 mark) \[\lambda = \int \text{HCOOH} \rightarrow \text{Ka} = \int \text{H30} \rightarrow \text{HCOOH} \rightarrow \text{HCL} \rightarrow \tex	M.C.O.O.H. ca.2)) (eg)	
(b) The molar conductivities of some electrolytes at infinite dilution at 25°C are given in the table below: Electrolyte	OR HCOOH CUEL + HZDO	H3.U. cags J H.CO.O. ca	٤).:
(b) The molar conductivities of some electrolytes at infinite dilution at 25°C are given in the table below: Electrolyte	(ii) The expression for the acid disso	ciation constant ka, for methanoic ac	id. (1 mark)
(b) The molar conductivities of some electrolytes at infinite dilution at 25°C are given in the table below: Electrolyte	Ka = CHCC	ooTCH+] or ka	= CH30+][HCOO]
(b) The molar conductivities of some electrolytes at infinite dilution at 25°C are given in the table below: Electrolyte	CH	THOO	CHOOOH]
below: Electrolyte		1 deleter at infinite dilution at 2	25°C are given in the table
Sodium chloride 113.0	(b) The molar conductivities of some	electrolytes at infinite dilution at 2	.5 C are given in the table
Sodium chloride 113.0	below:		
Sodium chloride Sodium methanoate Sodium hydroxide Sodium hydroxide Hydrochloric acid Calculate the molar conductivity of methanoic acid at infinite dilution. (03 marks)		Molar conductivity at in	finite dilution (Scm ² mol ⁻¹⁾
Sodium methanoate Sodium hydroxide Sodium hydroxide Hydrochloric acid Calculate the molar conductivity of methanoic acid at infinite dilution. (03 marks)			
Sodium hydroxide Hydrochloric acid Calculate the molar conductivity of methanoic acid at infinite dilution. (03 marks) (03 marks)			
Calculate the molar conductivity of methanoic acid at infinite dilution. (03 marks) $ \begin{array}{cccccccccccccccccccccccccccccccccc$	Sodium hydroxide		
Calculate the molar conductivity of methanoic acid at infinite diffusion. (05 marks) (15 marks) (15 marks)	1	397.8	(03 marks)
from MaOH (ag) + HC (ag) Halles Thought The HCl - 1-0 Mach	Calculate the molar conductivity of	methanoic acid at infinite diffusion.	
1. (HCOOH) = -Lo (HCOONG) +-La HC1 Lo Mach	FINAL THOUSE	-> 1 6 (100) T 1/2 1/ (4 IT (00!)9	Si Cagini Machagi
	1 a (HCMAH) = 1 a (HCOO.	Man) + AaHCI - AaMachat.	

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The molar conductivity of a 0.05M me	thanoic acid so	olution is 24.3	318Scm ² mol ⁻¹ a	at 25 ⁰ C
Calculate		,		ii 25 C.
(i) Degree of ionization of methanoic	acid at 25 ⁰ C			(11/ 1-)
Degree of Instation of - 1-c-	101d at 25 C			(1½ marks)
Degree of Ionisation of = 10 - 24:315 385.8		•••••		
386 #	· · · · · · · · · · · · · · · · · · ·			
=0.063	6r 6'3/		<u>,</u>	•••••
(ii) Dissociation constant, ka of metha				(02 marks)
$k_{\alpha} = d^2c$				
$-(0.063)^2 \times 0.00$	511		· · · · · · · · · · · · · · · · · · ·	
1-0.063	- 2	118 ×10	noldn-3	
he table blow shows the atomic radius a				
f the periodic table.	ind the mist for		or some even	ions in period (i
	DAT -		C	Po
Element Standard electrode potential E°(v)	-2.37	-2.87	-2.89	-2.91
(ii) Give a reason for your answer in (Barlon has the high		ive electr	ode potent	(1½ marks)
(i) State the trend in standard electron	de potential of t	he elements?.		(1 mark)
The electrode potential.	of elements	becomes	more hegati	re from mag
to barium OB Elect	rode patent	ial increas	ies from ma	anesium to be
(ii) Explain your answer in (b) (i)		.,		(2 marks)
From magnesium to Barle	m atomisati	on energy.	Jon's crtion	energy and hi
energy decrease However	er both ate	misation	energy and	ionisa tian ene
decrease mare rapidly	than hydra	ation energy	a thus mak	ing the electr
potential negative			J	
podential negative				
771				
5. What is meant by the term: The star	ماميل ماميلي	notential for	some half cells	are shown below
	ndard electrode	potential for	some half cells	are shown below
energy			some half cells	are shown below
Fe^{3+} (aq) / Fe^{2+} (aq)	+0.7	6V .	some half cells	are shown below
Fe^{3+} (aq) / Fe^{2+} (aq) I^{2} (aq) / I^{-} (aq)		6V .	some half cells	are shown below
Fe^{3+} (aq) / Fe^{2+} (aq)	+0.7	6V .	some half cells	are shown below

	(i)	the cell convention for the combined cell.	(1 mad)
		Ptus / Irag, Izag // Fe as, Fe as / Ptus	(1 mark)
			•••••••••
	(ii)	the equation for the overall cell reaction	••••••
		27	$(1\frac{1}{2} \text{ mark})$
		$2I_{(98)} + 2Fe^{3t}_{(92)} \longrightarrow I_{2}(92) + 2Fe^{2t}_{(92)}$	·
	4) 0 1 1		
	(b) Calculate	the overall electrode potential for the cell.	(1½ marks)
	•••••	Ecell = Eo Earhode - Eo Carhode - Eo	
	•••••		
		= +0.22 Yolts.	
	••••••		
		whether the reaction is feasible or not	
			(½ mark)
		e reaction is feasible.	••••••
	(ii) Give	2 reason for your and	•••••
		a reason for your answer.	(½ mark)
)٢.9	e overall electrode potential (emf) of the cell is po	Stive
6.		standard electrode potential.	(02 marks)
		pland electrode potential is the potential difference or red	
		ished when a metal electrode is olipped in a I molar sol	
	mease	ared relative to the standard hydrogen electrock a	1.25°C and
	1.9+1	mosphere	
	(ii) Why	is it not possible to measure standard electrode potential absolutely?	(02 marks)
	This.	is because it is recessary to have a second electroc	le which also
	has.	its own potential difference with respect to its	salvtion
, ,	Hus	making the measurement relative rather than abs	alute
	(iii) Discu	ass the factors which affect the value of standard electrode potential.	(5½ marks)
		ation energy or sublination energy. higher the atomisation energy, the lower the electrode potential and officult. to convert the electrode potential and officult. to convert the element into gascous atoms.	value because it
			T
		The higher the ionisation energy, the lawer the electrod	e potential of
	the e	lement because it becomes difficult to convert gaseous	atoms Into gaseous
	<i>A.</i>	Hydration energy . FND	Latende potentia
	1	Hydration energy. END. The higher the hydration energy, the higher the ause the gaseous ions can easily be hydrated i	acgeaus solution
	peca	the gaseous long can easily be against	(14 4