

YISHUN INNOVA JUNIOR COLLEGE JC 2 PRELIMINARY EXAMINATION **Higher 1**

CANDIDATE NAME			
CG	INDEX NO	H1 GROUP	

CHEMISTRY

Paper 2 Structured Questions

Candidates answer on the Question Paper.

Additional Materials: Data Booklet

READ THESE INSTRUCTIONS FIRST

Write your name, index number and CG on all the work you hand in.

Write in dark blue or black pen.

You may use an HB pencil for any diagrams or graphs.

Do not use staples, paper clips, highlighters, and glue or correction fluid/tape.

Section A

Answer **all** questions.

Section B

Answer **one** question.

The use of an approved scientific calculator is expected, where appropriate.

A Data Booklet is provided.

At the end of the examination, fasten all your work securely together.

The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use				
Paper 1				
	/30			
Рар	per 2			
1	/14			
2	/6			
3	/10			
4	/14			
5	/16			
6 or 7	/20			
Penalty				
	/80			
Overall (P Percent	aper 1 & 2) tage (%)			
	/110			

[Turn over

30 August 2021

2 hours

8873/02

Section A

Answer **all** the questions in this section, in the spaces provided.

1	At 573K phosphorus(V) chloride, $PCl_5(g)$, decomposes to form phosphorus(III) chloride, $PCl_3(g)$, and chlorine, $Cl_2(g)$. A <i>dynamic equilibrium</i> is established as shown.						
		P	$Cl_5(g) \rightleftharpoons PCl_3(g) +$	- Cl ₂ (g) ու	umerical value	e of K _c = 0.625	
	(a)	(i)	Explain what is m	eant by the term dynam	nic equilibriun	า	[1]
	(4)	(י)	A dynamic equili	brium refers to a revers	sible reaction	where the forwar	d and
			reverse reaction	is are continuing at the	<u>e same rate</u> .		
		(ii)	Suggest and exp	plain two changes which	ch will increa	se the decomposit	tion of
			PC <i>l</i> ₅ .				[2]
			Addition of PCl ₅ equilibrium to shi	/ removal of Cl ₂ or F ft to the right to remove	<u>PCl₃ which w the added PC</u>	ill cause the <u>posit</u> <u>215</u>	<u>ion of</u>
			A smaller pressu	re / larger volume which	n will cause t	he <u>equilibrium posi</u>	tion to
			shift to the right to	o favour the formation of	<u>more gaseo</u>	<u>us particles.</u>	
		(iii)	The experiment w be 8.3 x 10^{-3} . D	vas repeated at 473K. T educe whether the dec	he numerical composition r	value of <i>K</i> _c was fo eaction is exother	und to mic or
			endothermic.				
			Explain your ans	wer.			[2]
	 A lower temperature favours <u>exothermic reaction</u> (so as to release heat and decrease temperature) At lower temperature, the value of <i>K</i>_c decreases, indicating that the backward reaction is favoured. Link: Since the backward reaction is exothermic, the decomposition reaction (forward reaction) is endothermic. 						e heat at the action
		(iv)	The first experime	ent at 573K was repeate	ed but the tota	al pressure was dou	ubled.
			Predict the effec answer.	t this would have on th	ne value of <i>h</i>	$K_{ m c}$ at 573K. Explain	ı your
			[No calculations a	are required.]			[1]
			K, remains unch	anged as temperature	is constant a	and K. is depende	ent on
			temperature only	/. /.			
	(b)	The ra reager	te of this reaction ts. The table show	h was measured at difference of the second s	erent initial c	oncentrations of th	ne two
			experiment	[CH ₃ CH ₂ CHC/CH ₃]	[I-]	relative rate	
			1	0.06	0.03	3	
2 0.10 0.03						5	

		3	0.06	0.05	5	
		4	0.08	0.04		
	<i>(</i> i)	Doduco the orde	r of reaction with reapo	t to oach of [C		nd [I-]
	(')	Explain your reasoning [2]				[2]
		M1: Using expe	riment 1 and 2, when	[CH ₃ CH ₂ CHC	C/CH ₃] increases	by 5/3
		times keeping [I [CH ₃ CH ₂ CHC/CH] constant, rate increa I ₃] = 1	ses by 5/3 tin	nes. Order of react	tion wrt
		M2: Using expe [CH ₃ CH ₂ CHC/CH wrt [I ⁻] = 1	riment 1 and 3, when I ₃] constant, rate incre	[I⁻] increase ases by 5/3 t	es by 5/3 times k imes. Order of re	eeping action
	(::)					la a L
	(11)	vvrite the rate eq	uation for this reaction,	stating the un	its of the rate const	tant, κ. [2]
		rate = $k[I^-][CH_3C]$	H ₂ CHC/CH ₃]			
		units of $k = dm^3$	mol ⁻¹ s ⁻¹			
	(:::)	Coloulate the rol	ativa rata far avparimar	+ 1		[4]
	(111)	Calculate the relation $3 - k (0.06)(0.03)$	alive rate for experimen	ll 4.		[1]
		$k = 1.6667 \times 10^3$	/			
		rate = (16667)(0)	08)(0.04) = 5.33 mol d	n ^{−3} s ^{−1}		
 (c)	<i>(</i> i)	An important rea	ection of $CHC_{l_0}(a)$ is the			ing the
(0)	(')	following reversit	ble reaction.		2 01 01 0 <i>1</i> 10 <i>1</i> 2(9), us	ing the
		5				
			$CHCl_3(g) + 2HF(g) \rightleftharpoons$	$CHC_{l}F_{2}(g) + 2$	2HC <i>l</i> (g)	
		Lioo the data to a	algulate the enthelmy of	and of road	ion ALL for the for	motion
		of CHC $lF_2(q)$ as	shown in the equation.	lange of react	$\Delta n_{\rm r}$, for the for	mation
		_(0)	• •			
			compound ent	halpy change	of formation,	
				$\Delta H_{\rm f}/\rm kJ~m$		
			$CHCl_3(g)$	-103.2	2	
				-482.4	2	
			HCI(q)	-213.	D	
			ΠO _l (g)	-92.0		
						[2]
		$\Delta H_r = (-482.2) +$	2(-92.3) - (-103.2) - 2	2(-273.3) = -1	7.0 kJ mol⁻¹	
	(ii)	Calculate the en	thalpy change for the fo	prward reaction	n in the equilibrium	above
	()	using bond energy	gy values from the Data	Booklet.	r in the equilibrium	[2]
		$\Delta H_r = BE(reactar)$	nts) – BE(products)			
		= BE(C-H) + 3BE	=(C-Cl) + 2BE(H-F)			
		$- 110 \pm 3(310)$	– [BE(C-H) + 2(562) – [410 ± 340 ±	-BE(U-Ul) + 2 $2(485) \pm 2(42)$	BE(U-F) + 2BE(H-1)	∪ <i>l</i>)] 1
		-410 + 3(340) +	$\frac{1}{2}(302) - [410 + 340 + $	2(400) + 2(40	1 = -20.0 KJ III0I	

(iii)	Explain why the value calculated in 1(c)(ii) is different from that calculated in 1(c)(i) . [1]
	Bond energies from Data booklet are average values and thus the value for the enthalpy change of combustion is only an estimated value.
	[Total: 16]

2	An experiment was carried out to determine the percentage of iron in a sample of iron wire. A 3.35 g piece of the wire was reacted with dilute sulfuric acid, in the absence of air, so that all of the iron atoms were converted to iron(II) ions. The resulting solution was made up to 250 cm ³ .					
	(a)	A 25.0 potass	0 cm ³ sample of this solution was acidified and titrated with 0.0250 mol dm ^{-3} sium dichromate(VI). The results are seen below			
			titration number12Initial burette reading / cm30.000.50Final burette reading / cm332.1032.50Volume of potassium dichromate used / cm332.1032.00			
		(i)	Complete the table above and find an average volume of potassium dichromate(VI) used in the titration. Leave all answers to 2dp. Hence, use the average volume of potassium dichromate to calculate the number of moles of dichromate(VI) ions used in the titration. [3]			
			[1] for both correct values in the table, must be 2dp Average volume of K ₂ Cr ₂ O ₇ used = $\frac{32.10+32.00}{2}$ = 32.05 cm ³			
			Number of moles of $Cr_2O_7^{2-} = 0.025 \times 32.05/1000 = 8.0125 \times 10^{-4}$ = 8.01 × 10 ⁻⁴ mol			
		(ii)	Using data from the <i>Data Booklet</i> , complete and balance the ionic equation for the reaction between the dichromate(VI) ions and the iron(II) ions. [1]			
		Cr ₂ C	 $D_7^{2-}(aq) + 6Fe^{2+}(aq) +14H^+(aq) →2Cr^{3+}(aq) + 6Fe^{3+}(aq) +7H_2O(I)$			
		(iv)	Calculate the mass of iron in the 3.35 g piece of wire. [3]			
			No. of moles of Fe ²⁺ in 25 cm ³ of solution = $8.0125 \times 10^{-4} \times 6$ = 4.8075×10^{-3} No. of moles of Fe ²⁺ in 25 cm ³ of solution = $4.8075 \times 10^{-3} \times 250/25.0$ = 4.8075×10^{-2} mass of iron in the 3.35 g piece of wire = $4.8075 \times 10^{-2} \times 55.8$ = 2.6826 g = 2.68 g			
		(v)	Calculate the percentage of iron in the iron wire. [1]			
			Percentage of iron = $\frac{2.6826}{3.35}$ x 100% = 80.1%			
	(b)	Another student performed the same experiment but he accidentally used a lower concentration of potassium dichromate(VI). Explain the effect, if any, that the error will have on the mass of iron calculated. [2]				
		The <u>volume of aqueous potassium dichromate</u> (VI) needed for complete reaction with 25.0 cm ³ of the diluted solution will be higher / larger OR the <u>moles of Fe²⁺ calculated will be higher / larger</u> than what it actually would be as there will less moles of potassium dichromate(VI) present to react with the same amount of Fe ²⁺				

[Total: 10]

3	D , E , F , and G are four consecutive elements in the fourth period of the Periodic Table. (The letters are not the actual symbols of the elements.)						
	D is oxide	D is a soft, silvery metal with a melting point just above room temperature. Its amphoteric pxide, \mathbf{D}_2O_3 , has a melting point of 1900 °C and can be formed by heating D in oxygen.					
	G is G bu reac	G is a solid that can exist as several different allotropes, most of which contain G_8 molecules. G burns in air to form GO_3 which dissolves in water to form an acidic solution. This solution reacts with sodium bydroxide to form the salt Na ₂ GO ₄ .					
	(a)	(i)	Suggest the	identities of D ar	nd G .		[2]
			D		G		
					•		
			D: Co				
			D. Ga				
			G: Se				
		(ii)	Write equation	ons for the react	ions of D ₂ O ₃ with	1	
			I hvdrochlori	c acid.			[1]
				,			L·J
			$D_2 O_3(S) + 6F$	$ICI(aq) \rightarrow ZDCI_3$	$(aq) + 3\Pi_2 O(1)$		
			II sodium hy	droxide.			[1]
			$\mathbf{D} \mathbf{O} (\mathbf{a}) + \mathbf{O}$				
			$D_2O_3(S) + 3F$	$1_2O(1) + 2NaOH(1_2O(1))$	$aq) \rightarrow 2NaD(OF)$	1)4(aq)	
		(iii)	Write an equ	ation for the for	mation of an aci	dic solution whe	en GO3 dissolves in
			water.				[1]
				$H_{0}(I) \rightarrow H_{0}(O_{1}(2))$	a)		
			$90_3(1) + 11_20$	$\gamma(1) \rightarrow 11_200_4(a)$	4/		
	(b)	State	and explain the	he trend in volati	ility of chlorine, b	promine and iodi	ne down the group.
							[2]
		•	Volatility of	f the group 17 e	elements decrea	ases down the	aroup
				na aviat as air	mole acyclent n		simple melecular
		•	The haloge	ens exist as sir	npie covalent n		simple molecular
			structure a	nd are non-pola	r (i.e. Cl_2 , Br_2 , ar	10 I ₂).	
		•	The strengt	th of instantan	eous dipole-inc	duced dipole (id-id) interactions
			between th	e molecules in	creases as the	size of the elec	ctron cloud in each
			molecule in	creases.			
		•	The amoun	t of energy rec	wired to overcor	me the id-id int	eractions between
			the molecul	on in order to vo	parias the holog	op inoroacoo	cractions between
					ponse ine nalogi	on muitasts.	
		·					
	(C)	The f	ifth to eighth io	onisation energie	es of two elemen	its in the third pe	eriod of the Periodic
		Table are given. The symbols used for reference are not the actual symbols of the					
		elements.					
					ionioation anan	aioo / k l mal-1	
					ionisation energy	gies / KJ mol ⁻	
				tifth	sixth	seventh	eighth
			Х	7012	8496	27 107	31 671
			Y	6542	9362	11 018	33 606
				1	<u> </u>	-	
		(i)	State and ex	nlain the group r	number of olomo	nt V	[0]
1		U		piani ne group i		ATT 1.	[ک]



	Going across Period 3, there is an increase in nuclear charge because of the increasing number of protons but they have approximately the same shielding effect . Consequently, the effective nuclear charge increases across the. Therefore, the amount of energy required to remove the valence electron increases .
	[Total: 14]

Polylactic acid (PLA) is a plastic made from polymerisation of lactic acid, CH₃CH(OH)COOH. PLA has become a popular material due to it being economically produced from renewable resources. In 2010, PLA had the second highest consumption volume of any bioplastic of the world. PLA is used for making items as diverse as packaging materials, surgical thread and clothina. (a) (i) Draw a repeat unit for PLA and state the type of polymerisation involved. repeat unit for PLA type of polymerisation:condensation [2] (ii) Explain why PLA cannot be used to make containers that store strongly alkaline cleaning solutions. The condensation polymer is unstable in the presence of alkalis, hydrolysis of the ester linkages can occur and the container will disintegrate. [1] Another polymer that is commonly used in clothing is Nylon 6. (b) Nylon 6 has the following structure. —(CH₂)₅— -(CH₂)₅-Nylon 6 Draw the structure of the monomer used to make Nylon 6. (i) (CH₂)₅--OH [1] (ii) Explain why clothing made from Nylon 6 is prone to creasing while that made from PLA is wrinkle free. Nylon 6: Polyamide chains are bonded to one another via hydrogen bonding. The hydrogen bonds are broken / disturbed when water penetrate the areas between the chains. New hydrogen bonds are formed while it dries up and form creases.

	Terylene: a polyester which do not form hydrogen bonding between the thus is less prone to crease. polyamides form H-bonding between chains, but not polyester – 1m addition of water breaks the H-bonds and form new H-bonds – 1m	e ch	ains,
			[2]
		Tot	al: 6]

5	(a)	The p	armaceuticals aspirin, ibuprofen and paracetamol are all painkillers.				
			OF OF OF OF				
		0	он aspirin ibuprofen paracetamol				
		(i)	Infra-red absorptions can be used to identify functional groups in organic compounds. For example, ethyl ethanoate shows an absorption at $1710 - 1750$ cm ⁻¹ as shown in the <i>Data Booklet</i> .	с С			
			Bond Functional Group Absorption range / cm ⁻¹				
			C=O ester 1710 – 1750				
			Identify two infra-red absorption ranges that will be shown by aspirin and ibuprofen but not by paracetamol using the <i>Data Booklet</i> . Fill in your answers by completing the table above	t s			
			Accept any two of the following answers. One mark for each bond.				
			Relevant absorption range from Data Booklet (reference)BondFunctional groupAbsorption range / cm ⁻¹ C-OCarboxylic acids1210 – 1440C=OCarboxylic acids1680 - 1730O-HCarboxylic acids2500 - 3000				
			[2]	_			
		(ii)	Paracetamol reacts with hot dilute H ₂ SO ₄ . Identify the type of reaction whicl occurred and draw the structures of two organic products formed in the reaction	ו ו.			
			Reaction:				
			Products:				
			CH ₃ COOH +				
			Hydrolysis ⁺ H ₃ N ⁻				
		(
		(111)	Compound X is a derivative of ibuproten.				

			ОН	
			X	
			Identify the type of reaction that X is able to undergo but not ibuprofen.	
			Reaction:	
			Addition	
				[1]
	(b)	There	are four isomeric alcohols with the formula $C_4H_{10}O$.	
	()			
		One o	f them is butan-1-ol, which can be formed from 1-bromobutane in the labora	atory.
		(i)	State and explain whether butan-1-ol or 1-bromobutane has a higher bo	iling
		()	point.	3
			Butan-1-ol has a higher boiling point due to the stronger hydrogen bond	ding
			permanent dipole interactions between molecules of 1-bromobutane.	
				[2]
		(::)	Suggest reagents and conditions to convert 1 bromobutons to buton 1 of	
		(11)	NaOH(ag) heat	
				[1]
		(111)	Name and draw the structure of the isomeric alcohol which does not react acidified potassium dichromate(VI).	with
			Name:	
			2-methypropan-2-or	
			Structure:	
			CH ₃	
			H ₃ C — CH ₃	
			ÓH	
				[0]
				[2]
		(iv)	All four isomeric alcohols can undergo elimination to form alkenes.	
			Draw the structure of the alkene formed that exhibits cis-trans isomeris	m
			H H	
				[1]
				- 1
©YIJ(0		[Turn ov	/er

	(v)	Describe, in terms of orbital overlap, the bonding between the two carbon a of the C=C bond in an alkene.	atoms
		Valence orbitals from each carbon atom overlap head-on to give a sigma The p orbital from each carbon atom overlap sideways to give π bond .	bond.
			[2]
		[Tota	al: 14]

Section B

Answer **one** question from this section, in the spaces provided.

6	(a)	Define the term standard	enthalpy change of neutralisation.	[1]					
		Enthalpy change when an acid and a base react to form one mole of water at 298 K							
		and 1 bar.							
	(b)	In an experiment to dete	ermine the maximum change in temperature w	hen sodium					
		hydroxide is added to hydrochloric acid, 40 cm ³ solution of 2.0 mol dm ⁻³ hydrochloric acid is transferred to a polystyrene cup.							
		The initial temperature of the hydrochloric acid before sodium hydroxide is added is measured and recorded every minute for 3 minutes. At the 4 th minute, a 20 cm ³ solution of 2.0 mol dm ⁻³ aqueous sodium hydroxide is poured into the polystyrene cup containing the hydrochloric acid. The temperature of the resulting mixture is then measured every minute for a further 6 minutes.							
		The results are shown in	Fig. 6.1.						
		40							
		38							
		36							
				•					
		° ₀ 34							
		eratur							
		30							
		••••••••••••••••••••••••••••••••••••••							
		0 1 2	3 4 5 6 7 8 9	10 11					
		Time / min							
		Fig 6.1							

	(i)	Draw two separate straight lines of best fit. The first should take into account the points before sodium hydroxide was added. The second line should take into account the points after the reaction had finished. Extrapolate (extend) both lines to four minutes.
		Determine a value for the maximum temperature change, ΔT_{max} , at $t = 4.0$ min using the graph.
		Show your working. [2]
		$\Delta T_{max} = 38.6 - 29.6 = 9.0 ^{\circ}C$
	(ii)	The specific heat capacity of the mixture can be assumed to be 4.2 J K^{-1} cm ⁻³ . Using your value in 6(b)(i) , calculate the enthalpy change of neutralisation of the reaction. [3]
		Heat transferred, q = $(40 + 20) \times 4.2 \times 9.0$ = 2268 J = 2.268 kJ
		$NaOH(aq) + HCl(aq) \rightarrow NaCl(aq) + H_2O(l)$
		Amount of HC/ = 0.0800 mol; Amount of NaOH = 0.0400 mol
		Amount of water formed = 0.0400 mol
		$\Delta H_{n}^{e} = -(2.268 \div 0.04) = -56.7 \text{ kJ mol}^{-1}$
	(iii)	A student repeated the experiment using 20 cm ³ of 2.0 mol dm ⁻³ sodium hydroxide and 40 cm ³ of 2.0 mol dm ⁻³ aqueous ethanoic acid. All other conditions were kept constant.
		Suggest whether the temperature change will be more or less than your answer in 6(b)(i) and give an explanation for your answer. [2]
		Temperature change will be smaller than 9.0°C (answer in (b)(i)).
		CH ₃ COOH is a weak acid and it only dissociates partially in water. Energy is required to complete the dissociation of CH ₃ COOH to produce one mole of H ⁺ so that one mole of H ₂ O can be formed with one mole of OH ⁻ . Hence less energy is evolved or enthalpy change of reaction between ethanoic acid and sodium hydroxide will be less exothermic.
	(iv)	Calculate the pH of a 2.5 \times 10 ⁻⁴ mol dm ⁻³ solution of hydrochloric acid. [1]
		$pH = -lg (2.5 \times 10^{-4}) = 3.60$
(c)	(i)	Sketch a Boltzmann distribution curve and use it to explain the effect of a catalyst on the rate of reaction. [3]



	(ii)	The compound FO_2 does not exist, but ClO_2 does. Suggest a reason for this difference. [1]
		In CIO ₂ molecule, CI can expand octet due to available vacant 3d orbitals to accept electrons in forming covalent bonds with O .
		Or F cannot expand octet due to lack of available vacant 3d orbitals
		Or F is unable to form 2 dative bonds due to its high electronegativity.
	(iii)	C/O_2 forms the negative ion C/O_2^- .
		Draw a simple diagram to show how a water molecule can be attached to a ClO_2^- ion. Label the diagram to show the type of interaction involved. [1]
		C/O ² ion-dipole interaction
		$\delta^{+H} \sim \delta^{-} + \delta^{+}$
(d)	Silic elec	on carbide is a black solid with a melting point of 2730°C. It does not conduct tricity in the solid state nor in the liquid state. It is insoluble in water.
	Nam	ne the type of structure and describe the bonding in the solids silicon carbide. [2]
	SiC betv	has a giant covalent structure with strong and extensive covalent bonds veen Si and C atoms .
(e)	Prop	panoic acid undergoes a condensation reaction with ethanol.
	Nam	he the product and state the conditions needed for the reaction. [2]
	Ethy Con	l propanoate . centrated H₂SO₄ and heat
		[Total: 20]

7	(a)	Sodium sulfite is a pale yellow solid known for its reducing properties. It is used in the textile industry as a bleaching and desulfurizing agent. Its reducing properties are also exploited in swimming pools in the dechlorination of pool water.						
		It is	It is made industrially by reacting sulfur dioxide with a solution of sodium carbonate.					
			$SO_2 + Na_2CO_3 \rightarrow Na_2SO_3 + CO_2$					
		(1)						
		(1)	Draw the 'dot-and-cross' diagram of Na ₂ SO ₃ .					
			2 [Na ⁺] $\left[\begin{array}{c} : \ddot{O} \cdot \ast \ddot{S} \ast : \ddot{O} : \\ : \dot{O} \cdot \ast \ddot{S} \ast : \end{array} \right]^{2-}$					
				[1]				
		(ii)	State the shape of the sulfite anion.					
			Trigonal pyramidal.					
				[1]				
		(iii)	Predict whether Na ₂ CO ₃ or Na ₂ SO ₃ would have a higher melting point. Explain	n vour				
		(,	answer in terms of bonding.					
			Na ₂ CO ₂ would have a higher melting point					
			Both compounds have strong electrostatic forces of attraction bet	ween				
		oppositely charged ions.						
		$ $ attice energy $ \propto \left \frac{q_+ q}{r_+ + r} \right $						
		Since q_+ , r_+ and q are the same and <u>SO₃²⁻ has a larger radius</u> than CO ₃ ²⁻ ,						
		less energy is required to overcome the weaker ionic bonds in Na ₂ SO ₃						
				[2]				
	(b)	Aqu	eous ammonia is a weak base whereas barium hydroxide, Ba(OH)2, is a si	trong				
		base	9.	_				
		(i)	Explain the difference between a weak base and strong base.					
			A weak base partially dissociates in water to produce hydroxide ions wh	ile a				
			strong base completely dissociates in water to produce hydroxide ions	~~~~				
			Strong sado von pietery dissociates in water to produce invertexide foris.	[1]				
		<i></i>		Ļ				
		(11)	A solution of barium hydroxide has a pH of 12.5. Calculate the concentrat this solution of barium hydroxide.	ion of				
			pOH = 14 - 12.5 = 1.5					
			$[OH^{-}] = 10^{-1.5} = 0.031623 \text{ mol dm}^{-3}$					
			$[Ba(OH)_2] = 0.031623 \div 2 = 0.0158 \text{ mol dm}^3$					
				[2]				

19

		(iii)	iii) Write balanced equations to show how a mixture of aqueous ammonia and ammonium nitrate maintains pH when small amounts of acids and alkalis are added				
			$\begin{array}{c} \text{NH}_3 + \text{H}^+ \rightarrow \text{NH}_4^+ \\ \text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_2 + \text{H}_2\text{O} \end{array} $				[2]
	(c)	lodir	he and iodide ions undergo the follo	owing equilibriu	m in aqueous s	olution.	
			$I_2(aq)$ +	$I^{-}(aq) \rightleftharpoons I_{3}^{-}(aq)$	aq)		
		(i)	i) Write an expression for the equilibrium constant for this reaction, <i>K</i> _c , stating its units.				
			$\mathcal{K}_{c} = \frac{[I_{3}^{-}]}{[I_{2}][I^{-}]}$ Units: mol ⁻¹ dm ³				
							[2]
		(ii)	(ii) When 2.54 g of solid iodine is dissolved in 100 cm ³ of 1.00 mol dm ⁻³ KI, and allowed to reach equilibrium, the resulting $[I_3^-(aq)] = 9.98 \times 10^{-2}$ mol dm ⁻³ .				
			calculate a value for K_c .	טו [12(מק)] מווש ן	1 (ay)] II III		Enco
			Initial amount of I ₂ added = $2.54 \div (2 \times 126.9) = 0.010008$ mol				
			Initial $[I_2] = 0.010008 \div 0.1 = 0.10008 \text{ mol dm}^{-3}$				
1				l ₂ (aq) +	l⁻(aq) ⇔	l₃⁻(aq)	
			Initial concentration / mol dm ³	0.10008	1.00	0	
			Change in concentration / mol dm ³	-9.98 × 10 ⁻²	-9.98 × 10 ⁻²	+9.98 × 10 ⁻²	
			Equilibrium concentration / mol dm ³	2.79×10^{-4}	0.9002	9.98 × 10 ⁻²	
		$\mathcal{K}_{\rm c} = \frac{(9.98 \times 10^{-2})}{(2.79 \times 10^{-4})(0.9002)} = 397 \text{ mol}^{-1} \mathrm{dm}^3$					
							[3]
	(d)	The	polymer, acrylonitrile butadiene sty	/rene, melts on	heating. It is us	ed to make s	ports
		equi	pment and musical instruments su	ch as recorders	6.		
		Another synthetic polymer, polyurethane, chars (becomes blackened) on heating. It is used to make high-resilience foam seating and rigid insulation panels.				. It is	
		Sketch the structure of each polymer using as a simplified representation of the polymer chain. Include labels on your sketch. Classify each polymer and use its structure to explain its properties.					
		acrylonitrile butadiene styrene structure diagram:					

