2025 CCHY S4 Chemistry Preliminary Examination P2 Marking Scheme

Qn	Marking point	Marks
1(a)	A*l* or Fe	1
(b)	N or O	1
(c)	Fe	1
(d)	Ca	1
(e)	C	1
(f)	O or N	1
	Total	**6**
2(a)	Alkaline	1
	Concentration of hydroxide ions is **higher** than concentration of hydrogen ions *Reject amount*	1
(b)	Sodium sulfate; Na_2SO_4	2
	Sodium bicarbonate, $NaHCO_3$	
	Potassium sulfate, K_2SO_4	
	Potassium bicarbonate, $KHCO_3$	
	Magnesium sulfate, $MgSO_4$	
	Magnesium bicarbonate, $Mg(HCO_3)_2$	
	Calcium sulfate, $CaSO_4$	
	Calcium bicarbonate, $Ca(HCO_3)_2$ *Any two of the above*	
(c)	**Heating** to remove **all** the water/ evaporate to dryness *Reject heating/ crystallisation*	1
	Total	**5**
3(a)	X: concentrated ammonia Y: concentrated hydrochloric acid	1
	Mr of ammonia= **17** Mr of HCl= **36.5** Relative molecular mass of ammonia is **lower** than hydrogen chloride	1
	Ammonia (gas from X) will **diffuse faster and travel a longer distance** [answer can be of gas from Y]	1
(b)	Region P: **blue**	1
	Region R: **red**	1

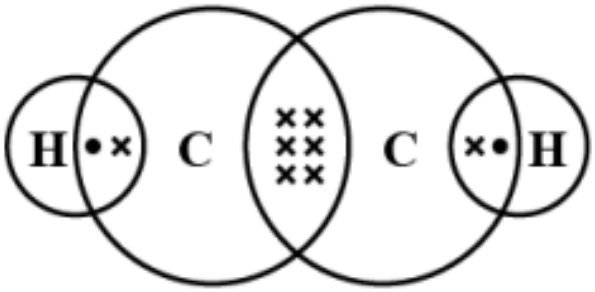
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Qn	Marking point	Marks
(c)	A **neutral salt** formed	1
	Total	**6**
4(a)	How: lithium atom **loses 1 valence electron** to form a **positively charged ion**	1
	How: chlorine atom **gains 1 valence electron** to form a **negatively charged ion**	1
	Why: to **achieve the full valence shell** of a noble gas	1
(b)	Describe: radius of lithium atom **decreases** when it forms an ion	1
	Explain: Lithium atom **loses 1 electron shell** when it forms an ion	1
(c)	Observation: **no visible change/ no observable change/ solution remains reddish brown**	1
	Explain: bromine is **less reactive** than chlorine thus **no displacement reaction takes place**	1
	Total	**6**
5(a)(i)	Catalytic converter converted the **harmful pollutants, CO, NO and unburnt hydrocarbons into harmless CO_2 and H_2O**	1
(ii)	The **excess** CO_2 produced will **lead to global warming** and thus will lead to extreme weather events	1
(b)	The **rate of photosynthesis to absorb CO_2 cannot catch up**	1
	with the **rate of CO_2 being released** during the combustion of fossil fuels and animals respiration	1
(c)	The **amount of CO_2 absorbed** by the sugar cane during **photosynthesis**	1
	is **equal** to	1
	the **amount of CO_2 released** when ethanol **burned as fuel**	1
	Thus there is net zero change in atmospheric CO_2	
	Total	**7**
6(a)	They formed **coloured** compounds	1
	They form compounds with **variable oxidation state**	1
(b)(i)	$2Cr\ (s) + 6H^+\ (aq) \rightarrow 2Cr^{3+}\ (aq) + 3H_2\ (g)$	1: correct balance eqn

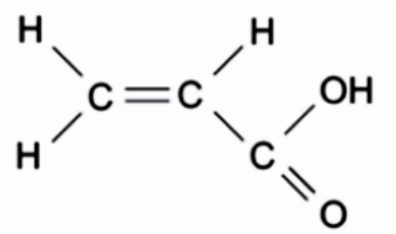
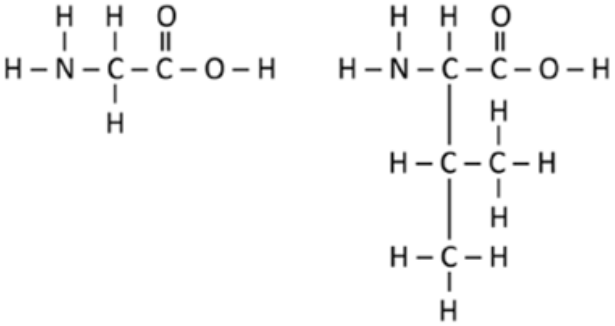
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Qn	Marking point	Marks
		1: correct state symbol
(ii)	**Cr** was **oxidized** as it **lost electrons** to form **$Cr^{3+}/Cr_2(SO_4)_3$.**	1
	H^+ / Hydrogen ion / H_2SO_4 was **reduced** as H^+ **gained the elections** to form **H_2**	1
(c)	Order of metal in increasing reactivity: **Iron, Chromium, Manganese**	1
	Observation in set up A: **Green solution turns pink, grey/silvery solid forms**	1
	Observation in set up B: **Green solution turns violet, grey/silvery solid forms.**	1
	Observation in set up C: **No visible / observable change / pale pink solution remains pink**	1
	Total	**10**
7(a)	Rate of reaction **increases with increasing** concentration of acid	1
	as there is **more reacting particles per unit volume**	1
	and there is an **increase in frequency of effective collision** between the reacting particles	1
(b)	6 min/ 9 min	1
(c)	No	
	Both are **monobasic acids and no of moles of acids used are the same**	1
	thus final volume of gas produced will be the **same**	1
(d)	No of moles of HCl = 0.5 x 18.50/ 1000 = 0.00925 mol	1
	No of moles of NaOH= 0.00925 mol	1
	Concentration of NaOH = 0.00925/ [20.0/ 1000] = 0.4625 mol/dm^3	1
	Concentration of NaOH = 0.4625 x (23 + 16 + 1) = 18.5 g/dm^3	1
	Total	**10**
8(a)	P_4	1
(b)	White phosphorus: simple molecular	1

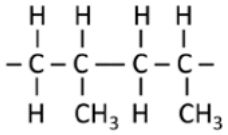
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Qn	Marking point	Marks
	Black phosphorus: giant covalent	
(c)	White phosphorus has a **lower melting point** than black phosphorus	1
	as **little** energy is absorbed to overcome the **weak forces of attraction between the molecules**	1
	And in black phosphorus**, a lo**t of energy is absorbed to overcome the **strong covalent bond between the P atoms**	1
(d)	It cannot conduct electricity in any state	
(e)	Layers of atoms can be peeled easily as it has **weak forces of attraction between the layers of atoms**	1
	Total	**8**
9(a)	**Boiling point increases** as **number of carbon atoms increases**	1
	Strength of the intermolecular forces of attraction **increases** as the **molecules become larger/ molecular mass increases**	1
	Thus **more energy absorbed** to overcome the forces of attraction	1
(b)		1: correct no of shared electrons 1: correct no of atoms
(c)(i)	C_nH_{2n-2}	1
(ii)	C_6H_{10}	1
(iii)	81 ^oC (accept any temp equal to or greater than 70 ^oC)	1
(d)	No of moles of calcium carbide= 500/ [40 + 2(12)]= 7.8125 mol No of moles of ethyne= 7.8125 mol	1
	Volume of ethyne= 7.8125 x 24 = 187.5 dm^3	1
(e)	Add **aqueous bromine/ bromine solution/ bromine** water to both sample	1
	Sample which turns from reddish brown to colurless/ decolourises **slower** contains alkyne	1

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Qn	Marking point	Marks
(f)		1
	Total	**12**
10(a)	Positive terminal	1
	$2Cl^- \rightarrow Cl_2 + 2e^-$	1
(b)	Describe: **Bubbles of gas/ efferevescence**	1
	Explain: **H^+ will be preferentially discharged** at electrode 1 to produce **hydrogen gas**	1
(c)	State: Electrolyte will change from green to purple/ blue	1
	Explain: **Caesium hydroxide** will be left behind in the electrolyte and it is an **alkali**	1
(d)(i)	From Zinc to Copper	1
(ii)	$Cu^{2+} + 2e^- \rightarrow Cu$	1
(iii)	State: Copper	1
	Explain: copper is reduced as oxidation state **decreases from +2** in Cu2+ **to 0** in Cu	1
	Total	**10**
11(a)		2

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<table>
<tr><th>Qn</th><th>Marking point</th><th>Marks</th></tr>
<tr><td>(b)(i)</td><td></td><td>1</td></tr>
<tr><td>(ii)</td><td>
<table>
<tr><td>Addition polymers

Poly(propene)</td><td>Condensation polymers

Protein</td></tr>
<tr><td>Monomers are linked to form one large molecule, poly(propene) with no loss of atoms.</td><td>Monomers are linked to form one large molecule, protein with the elimination of a small molecule, water.</td></tr>
<tr><td>Poly(propene) is formed from monomers that are unsaturated.</td><td>Protein is formed from monomers that contain the amine and carboxyl functional group.</td></tr>
<tr><td>Poly(propene) contain monomers are linked together with C-C bond.</td><td>Proteins contains monomers that are joined with the amide linkage.</td></tr>
</table>

Any 2 differences</td><td>2</td></tr>
<tr><td rowspan="2">(iii)</td><td>Mr of propene= 12(3) + 6(1)= 42</td><td>1</td></tr>
<tr><td>Number of repeating units= 5000/ 42 = 119.0476

Minimum no= 120</td><td>1</td></tr>
<tr><td>(iv)</td><td>Durable/ Tough/ Does not tear easily

Any reasonable answers</td><td>1</td></tr>
<tr><td rowspan="2">(v)</td><td>Equation: $C_{16}H_{34} \rightarrow 4C_3H_6 + C_4H_{10}$</td><td>1</td></tr>
<tr><td>Condition: High temperature of 600°C
Catalysts – Aluminium oxide and/or Silicon dioxide</td><td>1</td></tr>
<tr><td></td><td>Total</td><td>10</td></tr>
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