

2025 MSHS S4 Chemistry Prelim Paper 1 Answer

1	C	2	A	3	A	4	B	5	A	6	D	7	D	8	C	9	B	10	C
11	A	12	A	13	D	14	C	15	C	16	B	17	A	18	D	19	D	20	B
21	D	22	D	23	B	24	A	25	C	26	D	27	C	28	C	29	B	30	A
31	A	32	D	33	A	34	C	35	B	36	B	37	A	38	C	39	C	40	D

**Secondary Four Chemistry
Preliminary Examination 2025
Mark Scheme**

Paper 2

Section A

Qn No.	Answer	Mark
1ai	C	1
li	D	1
iii	B	1
iv	E	1
v	A	1
b	The amount of B/carbon dioxide is increasing due to the complete combustion of fossil fuels in vehicles and industries.	1
	It takes years for trees to grow, so the absorption of carbon dioxide through photosynthesis is much slower than the release of carbon dioxide by complete combustion of fossil fuels.	1
	Total	7
2a	The ions in lithium are held together by electrostatic forces of attraction between positive lithium ions and the sea of delocalised electrons .	1
	The ions in lithium chloride are held together by the electrostatic forces of attraction between positively charged lithium ions and negative charged chloride ions .	1
b	The melting and boiling points of lithium chloride are higher than that of lithium.	1
	The electrostatic forces of attraction between oppositely charged ions in lithium chloride is stronger than the electrostatic forces of attraction between lithium ions and the delocalised electrons in lithium metal.	1
(c)	Both Student A and Student B are incorrect OR Student B is incorrect and Student A is partly correct.	1
	Lithium can conduct electricity in all states because of the mobile electrons .	1
	Lithium chloride can conduct electricity when molten / dissolved in water because the ions are mobile , but not in the solid state because the ions are held in fixed positions and are not mobile .	1

Qn No.	Answer	Mark
d	One calcium atom (2, 8, 2) loses two electrons to two fluorine atoms, to form positively charged calcium ion (2, 8).	1
	Each fluorine atom (2, 7) gains one electron to form negatively charged fluoride ions (2,8).	1
	Total	9
3a	2 oxygen atoms and 1 chlorine with 4 shared pair of electrons	1
	chlorine atom with 1 lone pair and 1 unshared electrons	1
b	Chlorine has undergone disproportionation. Chlorine is oxidised because its oxidation state has increased from +5 in HClO_3 to +7 in HClO_4 .	1
	Chlorine is also reduced because its oxidation state has decreased from +5 HClO_3 to +4 in ClO_2 .	1
ci	$2\text{NaClO}_2 + \text{Cl}_2 \rightarrow 2\text{ClO}_2 + 2\text{NaCl}$	1
ii	Chlorine is the oxidising agent.	1
	It oxidises sodium chlorate to chlorine dioxide / it causes the oxidation state of chlorine to increase from +3 in sodium chlorate to +4 in chlorine dioxide.	1
	Total	7
4ai	$\text{C}_3\text{H}_4\text{O}_4$	1
ii	$\text{C}_2\text{H}_4\text{O}_2$ / CH_3COOH	1
	Ethanoic acid	1
iii	Ethyl ethanoate	1
iv	$ \begin{array}{ccccccc} & \text{H} & \text{O} & & \text{H} & \text{H} & \\ & & & & & & \\ \text{H} & - \text{C} & - \text{C} & - \text{O} & - \text{C} & - \text{C} & - \text{H} \\ & & & & & & \\ & \text{H} & & & \text{H} & \text{H} & \end{array} $	1
bi	Malonic has a higher pH because it is a weak acid.	1
	Total	6

Qn No.	Answer	Mark
ii	Chlorine dissolves / soluble in acid / solution	1
b	Mr of NaCl = 23 + 35.5 = 58.5 From eqn 2 moles NaCl produce 1 mole Cl₂ 2(58.5 g) NaCl produce 71 g Cl₂ 117 g NaCl produce 71 g Cl₂ 117 tonnes NaCl produce 71 tonnes Cl₂ 23.4 tonnes NaCl produce (23.4 ÷ 117) x 71 tonnes Cl₂ = 14.2 tonnes No. of mole of Cl₂ = 142 000 000 mol ÷ 71 g/mol = 200 000 Volume of Cl₂ = 200 000 x 24 dm³ = 4.80 x 10⁶ dm³	1 1 1
c	Seawater is a concentrated sodium chloride solution. Electrolysis of concentrated sodium chloride solution produces chlorine which is toxic. Add water to dilute the seawater. Electrolysis dilute sodium chloride solution produces hydrogen and oxygen.	1 1
	Total	9

Qn No.	Answer	Mark
7	Advantages of fermentation / disadvantages of hydration: - Sugar cane can be re-grown/is renewable but crude oil is non-renewable/finite/cannot be replaced. - Fermentation of glucose uses a lower temperature (30 °C) than hydration of ethene (300 °C), so energy cost is lower than that for hydration of ethene. - Fermentation of glucose uses a lower pressure (1 atm) than hydration of ethene (60–70 atm) so energy cost/cost of equipment to maintain the pressure is lower than that for hydration of ethene. - Yeast is a natural substance and not harmful whereas phosphoric acid is corrosive. Advantages of hydration / disadvantages of fermentation: - Hydration of ethene is a faster process whereas fermentation is a slower process. - Hydration of ethene produces pure ethanol whereas fermentation produces impure ethanol. Any four of the above points	4
	Total	4
8ai	$\left[\begin{array}{cc} \text{H} & \text{H} \\ & \\ -\text{C} & - & \text{C}- \\ & \\ \text{H} & \text{CONH}_2 \end{array} \right]_n$	1
ii	Add aqueous sodium hydroxide to a solution containing ammonium ions. Warm the mixture gently. If the gas turns damp red litmus paper blue (ammonia), then ammonium ions are present.	1 1
bi	Condensation polymerisation	1
ii	$\begin{array}{ccccccc} \text{H} & & \text{O} & & \text{H} & & \text{O} & & \text{H} & & \text{O} \\ & & & & & & & & & & \\ -\text{N}-\text{CH}_2-\text{C} & - & \text{N}-\text{CH}-\text{C} & - & \text{N}-\text{CH}-\text{C}- \\ & & & & & & & & & & \\ & & \text{CH}_3 & & & & \text{CH}_2\text{OH} & & & & \end{array}$	1

Qn No.	Answer	Mark						
c	Addition polymerisation of acrylamide in (a) produces only <u>one</u> product, the <u>polymer</u> whereas the condensation polymerisation in (b) produces the polymer and water as a <u>by-product</u>. The mass of the polymer in (a) is the <u>same</u> as the mass of all the monomers added together whereas the mass of the polymer in (b) is <u>less</u> than that of all the monomers. For addition polymerisation of in (a), the monomer has a carbon-carbon double bond. For the condensation polymerisation in (b), the monomers has a <u>functional</u> group at each end of the molecule. Any two of the above differences.	2						
	Total	7						
9a	<table border="1"> <tr> <td>chromatography technique</td><td>stationary phase</td><td>mobile phase</td></tr> <tr> <td>paper chromatography</td><td>chromatography paper</td><td>ethanol</td></tr> </table>	chromatography technique	stationary phase	mobile phase	paper chromatography	chromatography paper	ethanol	2
chromatography technique	stationary phase	mobile phase						
paper chromatography	chromatography paper	ethanol						
bi	Component D	1						
ii	Components B and C	1						
iii	Component D	1						
ci	72	1						
ii	C₅H₁₂ It is a saturated hydrocarbon since it does not decolourise aqueous bromine.	1 1						
iii	C₅H₁₂ + 8O₂ → 5CO₂ + 6H₂O reactants and products balanced equation	1 1						

Qn No.	Answer	Mark
iv	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \begin{array}{ccccc} & \text{H} & & \text{H} & \\ & & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array} \end{array}$ $\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \begin{array}{ccccc} & \text{H} & & \text{H} & \\ & & & & \\ \text{H}-\text{C}-\text{C}-\text{C}-\text{H} \\ \quad \quad \quad \\ \text{H} \quad \text{H} \quad \text{H} \quad \text{H} \end{array} \end{array}$	2
	Total	12

Section B

Qn No.	Answer	Mark
10ai	(least) L , hydrogen, K , J and M (most)	1
ii	M is a reactive metal which reacts with water (present in silver nitrate solution) to form hydrogen gas .	1
iii	Copper $\text{Cu(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Ag(s)}$	1 1
bi	Oxide of metal L turns from black to red-brown as it is reduced by hydrogen to form metal L (red-brown). This shows that hydrogen is more reactive than metal L (copper). Oxides of metals K , J and M remain white as they are not reduced by hydrogen . This shows that hydrogen is less reactive than metals K , J and M , it cannot reduce oxides of metal K , J and M .	1 1 1
ii	Metal L (or Copper). Iron is more reactive than metal L . Iron loses electrons more readily than metal L , the electrons will move to metal L . Hence corrosion of iron becomes faster.	1 1 1
	Total	10
11a	Copper and zinc	1
bi	Copper	1
ii	Powdered Zamak has smaller particle size with greater surface area exposed to the acid for reaction. Thus, the frequency of effective collisions increases and rate of reaction is higher.	1 1
c	Atoms in pure zinc are of the same size and arranged in an orderly manner . Layers of atoms can slide over one another. Different sizes of atoms (aluminium, copper & magnesium) in the alloy disrupts the orderly arrangement , making it difficult for the layers of atoms to slide over one another.	1 1
di	Non-biodegradable materials are not easily decomposed by bacteria in the soil and hence they have a longer life span. However, disposal of non-biodegradable materials result in accumulation of waste in landfill, causing environmental pollution.	1 1

Qn No.	Answer	Mark
ii	Sacrificial protection. Metal in sacrificial metal loses electrons more easily than iron / sacrificial metal oxidised in preference to iron / sacrificial metal more reactive (magnesium) than iron. OR Covering the iron with plastic prevents iron from coming into contact with oxygen and/or water.	1 1
	Total	10