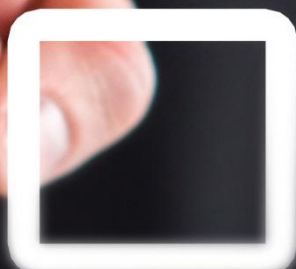




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MATSEC
Examinations Board



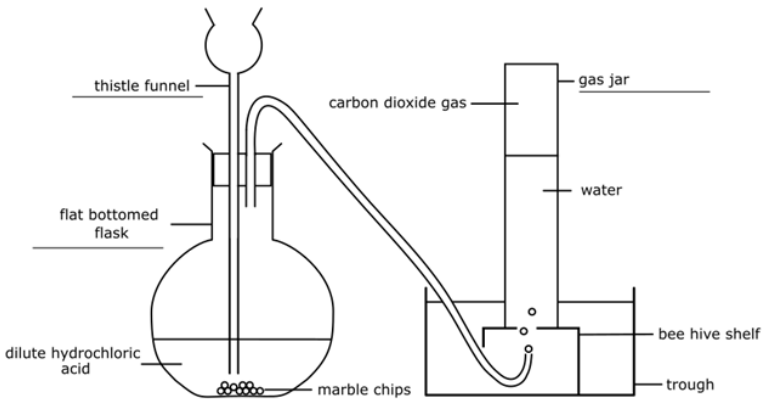
Marking Scheme
SEC Chemistry

First Session 2025

Marking schemes published by the MATSEC Examination Board are not intended to be standalone documents. They are an essential resource for markers who are subsequently monitored through a verification process to ensure consistent and accurate application of the marking scheme.

In the case of marking schemes that include model solutions or answers, it should be noted that these are not intended to be exhaustive. Variations and alternatives may also be acceptable. Examiners must consider all answers on their merits, and will have consulted with the MATSEC Examinations Board when in doubt.

PAPER I
LEVEL 1-2-3

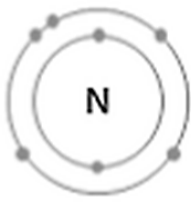
Question		Suggested Answers	Additional comments	Marks	
1	a	Substance S: Magnesium chloride - Do not accept: Salt Substance T: Water	1 1	2	
	b	i	The blue litmus paper.		1
		ii		1 mark for each label	3
	c	Forms a solid with lime water/ lime water turns cloudy/ forms calcium carbonate with lime water/ lime water turns milky.		1	
Total:				7	
2	a	Step 3: Filter the rock salt and water mixture / filter. Step 4: Collect the filtrate / collect the water and salt solution.	1 1	2	
	b	Pestle and mortar/ place between sheets of paper and crush using a heavy object/ press down on them with a metal spatula / stirring rod.		1	
	c	Solid decreases/ solid dissolves/ salt dissolves. Not all the solid dissolves/ some solid particles left.	1 1	2	
	d	Insoluble solids remain on the filter paper.		1	
	e	Beaker with water + evaporating basin + tripod + heat source indication.	1 mark for setup. 2 marks for 2 labels.	3	
Total:				9	
3	a	Substance 1: lead (II) nitrate Substance 2: hydrochloric acid / potassium chloride	1 1	2	
	b	$\text{Pb}(\text{NO}_3)_2 + 2\text{HCl} \rightarrow \text{PbCl}_2 + 2\text{HNO}_3$ OR $\text{Pb}(\text{NO}_3)_2 + \text{KCl} \rightarrow \text{PbCl}_2 + 2\text{KNO}_3$	1 for formulae. 1 for balancing.	2	

	c		Test tube/beaker/conical flask. Solutions if starting with 2 salts/dilute hydrochloric acid. Do not award mark if 'solutions' and 'dilute' (if applicable) are missing. Filter + wash + method of drying. Do not accept 'dry' on its own.	1 2 3	6
Total:				10	
4	a	i	Acceptable circuit to show DC power supply, electrodes in crucible, heating of crucible.	1 for setup, 3 for 3 labels	4
		ii	Remove crucible and heating equipment then place the electrodes in ethanol/ add a container with ethanol and electrodes into the circuit in series.		1
		iii	Part (a) (i): Gas given off at the anode. Shiny layer at the cathode. Also accept bulb lights or ammeter shows a reading. Part (a) (ii): No current flows/ bulb does not light/no effect on ammeter/ no change observed.	1 1 1	3
	b	Molten lead (II) bromide conducts electricity. Ethanol does not conduct electricity.	1 1	2	
Total:				10	
5	a		Use of fume cupboard, use of any kind of protective clothing. Do not accept: no eating / playing around.	Any two.	2
	b		3 test tubes with KCl, KBr, KI respectively When chlorine bubbled into each. No reaction with KCl Bromine given off from KBr /red brown bromine Iodine produced from KI/ dark brown/black	1 1 1 1	9
			Bromine added to each No reaction with KCl or KBr Iodine produced from KI	1 1 1	
c		Iodine > bromine > chlorine	1	1	
Total:				12	

6	a		Dropping funnel, beaker, measuring cylinder, filter tunnel/funnel, round bottomed flask, conical flask		6
	b	i	B, D, C, A correct order = 3, one out of place= 2, two out of place = 1		3
		ii	To ensure the solution is homogeneous / everywhere the same concentration.		1
		iii	No loss of solid/ transfer all the solution in the beaker/ rinse out the beaker/if a funnel is used it must be removed/read at eye level/ read at bottom of meniscus/ do not use filter paper to weigh/ no draught when weighing / any other reasonable precaution.		2
Total:					12
7			a. galvanise / paint b. vacuum chamber / grease c. paint d. galvanise e. grease f. grease / paint g. galvanise / paint	1 mark each.	7
Total:					7
8	a		As heat is being supplied constantly to the water: In stage A the energy being supplied increases the temp. of the substance until it reaches its melting point.	1	5
			Then in stage B, the energy being supplied does not change the temperature but brings about a change of state from solid to liquid.	1	
			Then in stage C, the energy being supplied increases the temperature of the liquid until it reaches its boiling point.	1	
			Then in stage D, the energy being supplied does not increase the temperature but brings about a change of state from liquid to gas.	1	
			Then in stage E, the energy being supplied increase the temperature of the gas.	1	
	b	i	A solid; E gas	1, 1	2
		ii	Temperature at B: 0 °C	1	2
Temperature at D: 100 °C			1		
iii	In part A the particles are vibrating about a fixed position / not moving while in part E they move around randomly. Part A close together part E far apart.	1 1	2		
Total:					11

9	a	i	1. Weigh the crucible empty and then with the copper turnings inside. 2. Place the crucible with copper turnings on the tripod and wire gauze/pipe clay triangle. 3. Heat the copper gently until all has reacted/until no more copper is seen or similar. 4. Weigh the crucible. 5. Repeat steps 3 and 4 until a constant mass is achieved.	1 mark for each step.	5
		ii	Allow the crucible to cool before weighing/ use tongs to hold the hot crucible.	Accept any valid.	
	b		Mass of oxygen = 9.94 g - 7.93 g = 2.01 g Qty of copper (mol) = 7.93/63.5 = 0.125 mol Qty of oxygen (mol) = 2.01/16 = 0.125 mol Ratio Cu: O = 1:1 / Empirical Formula = CuO	1 1 1 1	4
Total:					10
10	a	i	Slower rate sketch shown below current graph peaking later. Same volume of CO ₂ .	1 1	2
		ii	Powder.		
	b		Increasing the temperature. Accept increasing concentration of the acid. Do not accept surface area.		1
	c		To ensure fair testing/ to compare like with like.		1
Total:					5
11	a		Exothermic		1
	b		Spirit lamp + known mass of ethanol. Calorimeter / insulated container with known mass of water. Calorimeter on tripod and gauze and spirit lamp underneath. Thermometer in water used as stirrer (/not touching sides or bottom) to measure the temperature change of the water. (Accept the thermometer and stirrer.) Record change in temperature of water after it stops rising. Weigh spirit lamp to know the mass of ethanol combusted.	1 1 1 1 1 1	6
Total:					7

PAPER II LEVEL 1-2

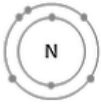
Question		Suggested Answers	Additional comments	Marks
1	a	Group 1: Alkali metals Group 7: Halogens	1 1	2
	b	Bleaching / antibacterial action of chlorine in water. <i>Accept other valid answers.</i>		1
	c	Sodium hydrogencarbonate is present in baking powder. Cleaning agent. <i>Accept other valid answers.</i>		1
	d	Boiling point increases.		1
	e	The elements change from gas to liquid to solid. Award marks only if the three states of matter are listed in order.		1
Total:				6
2	a	Aluminium		1
	b	True, False, False	1 mark each.	3
	c	Second option (Have a fixed shape and volume.)		1
	d	Painting, galvanisation, greasing, ion-exchange resin.	Any one of.	1
	e	To build cars, ships, in the construction etc. <i>Accept any reasonable answer.</i>		1
Total:				7
3	a	number of protons = 7, number of neutrons = 7, number of electrons = 7		1
	b	 <i>1 mark for drawing two shells. 1 mark for correct order of electrons in shells.</i>		2
	c	A compound is a substance made up of 2 or more different elements chemically joined together. A mixture is made up of 2 or more different substances not chemically joined together.	1 1	2
	d	78%		1
	e	Nitrogen is a highly unreactive/inert gas. Using nitrogen excludes oxygen from the packaging and so prevents food spoilage.	1 1	2
Total:				8

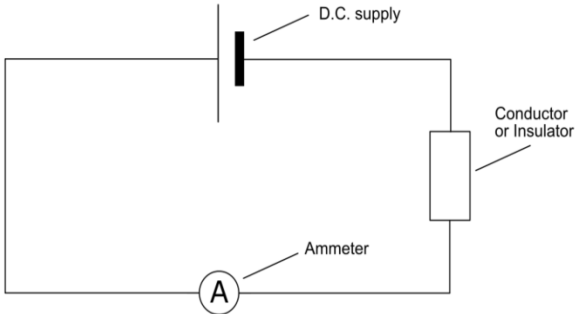
4	a	A: alkaline	1	3															
		B: alkaline	1																
		C: acidic	1																
	b	Universal indicator		1															
c	i	Alkaline		1															
	ii	Acidic		1															
Total:				6															
5	a	Acid-base	1	4															
		Combustion	1																
		Thermal decomposition	1																
Precipitation		1																	
b	Hydration of copper(II) sulfate, thermal decomposition of ammonium chloride, or any other reversible reaction.			1															
c				1															
Total:				6															
6	a	<table border="1"> <thead> <tr> <th>Substance</th> <th>Conduct</th> <th>Does not conduct</th> </tr> </thead> <tbody> <tr> <td>Seawater</td> <td>✓</td> <td></td> </tr> <tr> <td>Copper(II) chloride crystals</td> <td></td> <td>✓</td> </tr> <tr> <td>Copper</td> <td>✓</td> <td></td> </tr> <tr> <td>Dilute copper(II) sulfate</td> <td>✓</td> <td></td> </tr> </tbody> </table>	Substance	Conduct	Does not conduct	Seawater	✓		Copper(II) chloride crystals		✓	Copper	✓		Dilute copper(II) sulfate	✓		1 mark each.	4
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		Seawater	✓																
		Copper(II) chloride crystals		✓															
		Copper	✓																
Dilute copper(II) sulfate	✓																		
b	Copper		1																
<i>Do not award marks if other options are given.</i>																			
c	At the cathode: A reddish-brown/pink solid is observed.	1	2																
	At the anode: Bubbles of yellow green gas are observed.	1																	
Total:				7															
7	a	i	fossil	1															
		ii	mixture	1															
		iii	hydrogen	1															
	b	Fractional distillation.			1														
	c	Miscible liquids are liquids that mix, whereas immiscible liquids are liquids that do not mix.		1	2														
				1															
	d	Transporting fossil fuels to islands enables these regions to access a reliable and consistent energy source, which is essential for supporting their economies, powering infrastructure, and maintaining daily activities. It also provides energy independence to areas with limited natural energy sources. (Any one of the above answers.)			1														
e	Oil spillages, leaks in water during fossil fuels extraction and refining. (Any one of the above answers.)			1															
f	Desulfurization.			1															
Total:				9															

8	a	Groundwater/aquifers/perched aquifers.		1												
	b	1. High pressure is applied on seawater. 2. Water passes through a semipermeable membrane, 3. leaving larger ions behind.	1 mark for each step.	3												
	c	Calcium and magnesium ions. <i>Accept their symbols including state symbols.</i>	1,1	2												
	d	Clogging of hot water pipes and limescale on electric heating elements.	1 1	2												
	e	B		1												
	f	Solute		1												
	g	Evaporation/Boiling		1												
Total:				11												
9	a	<table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>Homologous series</th> <th>Organic compound</th> </tr> </thead> <tbody> <tr> <td>Alkanes</td> <td>A or E</td> </tr> <tr> <td>Alkenes</td> <td>D</td> </tr> <tr> <td>Alkynes</td> <td>B</td> </tr> <tr> <td>Alcohols</td> <td>C</td> </tr> <tr> <td>Carboxylic acids</td> <td>F</td> </tr> </tbody> </table>	Homologous series	Organic compound	Alkanes	A or E	Alkenes	D	Alkynes	B	Alcohols	C	Carboxylic acids	F	1 mark each.	5
	Homologous series	Organic compound														
	Alkanes	A or E														
	Alkenes	D														
	Alkynes	B														
	Alcohols	C														
	Carboxylic acids	F														
b	B and D	1,1	2													
c	i	Isomers are molecules having the same formula but a different arrangement of atoms.		1												
	ii			1												
d	i	Plastic bags. <i>Do not accept plastic as an answer</i>		1												
	ii	Reduce or reuse or recycle. <i>Accept any one of the answers, if multiples are given mark only the first one.</i>		1												
	iii	Releases carbon dioxide, a greenhouse gas/releases carbon monoxide if incomplete combustion occurs, produces toxins. <i>Accept any one of the answers</i>		1												
Total:				12												

10	a	<table border="1"> <thead> <tr> <th>Cation</th> <th>Flame test</th> </tr> </thead> <tbody> <tr> <td>Sodium</td> <td>Orange-red</td> </tr> <tr> <td>Potassium</td> <td>Red</td> </tr> <tr> <td>Calcium</td> <td>Lilac</td> </tr> <tr> <td>Lithium</td> <td>Golden yellow</td> </tr> </tbody> </table>	Cation	Flame test	Sodium	Orange-red	Potassium	Red	Calcium	Lilac	Lithium	Golden yellow	1 mark for each match.	4
	Cation	Flame test												
Sodium	Orange-red													
Potassium	Red													
Calcium	Lilac													
Lithium	Golden yellow													
b	hydrochloric acid, carbon dioxide, limewater	1,1,1	3											
Total:				7										
11	a	$\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$ 1 mark for formulae, 1 mark for balancing, 1 mark for state symbols.		3										
	b	Increasing the temperature and increasing the surface area of magnesium. Accept increasing the concentration of the acid	1 1	2										
	c	Negative		1										
	d		1 mark for each label. 1 mark for diagram.	5										
	e	Combustion, neutralisation, water and calcium oxide. Accept any other reasonable answer.	Any two.	2										
Total:				13										
12	a	$\text{RFM of FeSO}_4 = 56 + 32 + (16 \times 4)$ $= 152$	1 – working 1 – answer	2										
	b	Mass of water in sample $10 - 5.5 = 4.5 \text{ g}$	1 – answer	1										
	c	Moles of FeSO_4 : $5.5/152 = 0.036 \text{ moles}$ H_2O : $4.5/18 = 0.25 \text{ moles}$ Apply follow through.	1 1	2										
	d	Mole ratio FeSO_4 : $0.036/0.036 = 1$ H_2O : $0.25/0.036 = 7$ Therefore, $x = 7$	1 1 1	3										
Total:				8										

PAPER II LEVEL 2-3

Question		Suggested Answers	Additional comments	Marks
1	a	number of protons = 7, number of neutrons = 7, number of electrons = 7		1
	b	 1 mark for drawing two shells. 1 mark for correct representation of electrons in shells.		2
	c	A compound is a substance made up of 2 or more different elements chemically joined together. A mixture is made up of 2 or more different substances not chemically joined together.		2
	d	78%		1
	e	Nitrogen is a highly unreactive/inert gas. Using nitrogen excludes oxygen from the packaging and so prevents food spoilage. Accept other valid answers related to the above reason.		2
Total:				8
2	a	Carbonic acid		1
	b	As the slightly acidic water passes through the rocks it dissolves (reacts with) certain minerals which make it hard. Do NOT accept water only. The metal ions which cause limescale are calcium and/or magnesium ions. Accept formulae of ions.	1 1	2
	c	False True	1 1	2
	d	$\text{Ca}(\text{HCO}_3)_2(\text{aq}) \rightarrow \text{CaCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$ OR $\text{Mg}(\text{HCO}_3)_2(\text{aq}) \rightarrow \text{MgCO}_3(\text{s}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$ 1 mark for formulae, 1 mark for balancing, 1 mark for state symbols.		3
Total:				8
3	a	Lime water: Blue;	1	2
		Lemon juice: No change. Accept Red.	1	
	b	They react with both acids and bases/alkalis. Accept they have acidic and basic properties.		1
	c	i	$\text{Ba}^{2+}(\text{aq}) + \text{SO}_4^{2-}(\text{aq}) \rightarrow \text{BaSO}_4(\text{s})$ 1 mark for formulae, 1 mark for balancing, 1 mark for state symbols.	
ii		3, 2, 4, 1		1
Total:				7

4	a	 <p style="text-align: center;"><i>Accept a light bulb instead of an ammeter.</i></p>	1 – setup 1 – labels	2	
	b	<p>Conductors conduct by means of delocalised/free electrons while electrolytes conduct by means of free ions.</p> <p><i>Accept: Conductors conduct current electricity and remain unchanged while electrolytes conduct current electricity and decompose in the process.</i></p> <p><i>Do NOT accept answers that do not give a reason why conductors /electrolytes conduct electricity.</i></p>	1 1	2	
Total:				4	
5	a	Gaseous state.		1	
	b	i	$\text{Cl}_2(\text{g}) + 2\text{Br}^-(\text{aq}) \rightarrow 2\text{Cl}^-(\text{aq}) + \text{Br}_2(\text{l})$ 1 mark for formulae, 1 mark for balancing, 1 mark for state symbols. <i>Do not mark if a balanced chemical equation is given instead.</i> Accept $\text{Br}_2(\text{aq})$.		3
		ii	Chlorine. Gains electrons.	1 1	2
	c	Potassium is more reactive than lithium. Lithium atoms are smaller than potassium atoms, so the outermost electrons are more strongly held.	1 1	2	
Total:				8	
6	a	i	Add acidified barium chloride solution to separate solutions of the compounds. The potassium sulfite will not form a precipitate. The potassium sulfate will form a white precipitate. <i>Do not accept the test without mentioning the addition of acid.</i>	1 1 1	3
		ii	Add acidified silver nitrate solution to separate solutions of the compounds. The sodium chloride forms a white precipitate. The sodium iodide forms a pale-yellow precipitate. <i>Do not accept the test for halides without reference to it being acidified.</i>	1 1 1	3

	b	Solid X = copper(II) nitrate <i>Do not accept copper or Cu</i> Gas Y = ammonia <i>Accept formulae.</i>	2 1	3
Total:				9
7	a	Open quarrying generates employment and/or contributes to economic development.		1
	b	Noise pollution caused by the quarry machinery and large heavy vehicles used for the transport of the construction material. Air pollution caused by dust and exhaust from the engines of the quarry machinery and heavy vehicles. Habitat destruction which occurs when the trees and surface soil are removed. Groundwater contamination occurs when dust and machinery oils come into contact with water. <i>Accept any two or other valid answers related to environmental impact.</i>	For each: 1 – issue 1 – explanation	4
Total:				5
8	a	$\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ 1 mark for formulae, 1 mark for balancing.		2
	b	Carbon monoxide is oxidized. The oxidation number of carbon in CO is +2, while that of carbon in CO ₂ is +4. <i>Both oxidation numbers must be correct.</i>	1 1	2
	c	Iron (III) ions gain electrons to form iron.		1
	d	Limestone is added to remove impurities.		1
	e	Slag		1
Total:				7
9	a	RFM of FeSO ₄ = 56 + 32 + (16 x 4) = 152 <i>Do not accept 152 g or any partial correct calculations.</i>	1 – working 1 – answer	2
	b	Mass of water in sample 10 – 5.5 = 4.5 g		1
	c	Moles of FeSO ₄ : 5.5/152 = 0.036 moles H ₂ O: 4.5/18 = 0.250 moles	1 1	2
	d	Mole ratio FeSO ₄ : 0.036/0.036 = 1.000 H ₂ O : 0.250/0.036 = 6.944 rounded to 7 x = 7 <i>Apply follow through.</i>	1 1 1	3
Total:				8

10	a	Increase in amount of product with time. OR Decrease in amount of reactant with time. <i>Do NOT accept other variations.</i>		1
	b	i	Burette and Bunsen burner must be circled.	1,1 2
		ii	Put one of the 50 cm ³ samples of hydrogen peroxide in the conical flask. Add the catalyst and connect the gas syringe. Repeat experiment without the catalyst.	1 1 1
	iii	The experiment which uses the catalyst would produce oxygen at a much faster rate than the one which has no catalyst.		1
	iv	Use a weighing balance to measure the rate of loss in mass due to the emission of oxygen gas. <i>Accept other valid answers.</i>		1
Total:				8
11	a	Heat energy is required for ethanol to become a gas. This energy is changed into kinetic energy eventually breaking the intermolecular forces of attraction holding the molecules together.	1 1	2
	b	When compressed the space between the gas particles is decreased so it becomes a liquid. In a liquid the particles are already close together so a change in pressure will not have any effect.	1 1	2
Total:				4
12	a	C_nH_{2n+2}		1
	b	<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> $\begin{array}{cccc} H & H & H & H \\ & & & \\ H-C & -C & -C & -C-H \\ & & & \\ H & H & H & H \end{array}$ </div> <div style="text-align: center;"> $\begin{array}{ccc} H & H & H \\ & & \\ H-C & -C & -C-H \\ & & \\ H & & H \\ & & \\ H-C & -H & \\ & & \\ H & & \end{array}$ </div> </div>	1 mark each.	2
	c	The molecules are held together by weak intermolecular forces of attraction which increase in strength with increasing molecular size. As the molecules get larger their boiling points increase.	1 1	2
	d	i C_7H_{16} ii Propene iii Double bond		1 1 1

