



Bhutan Council for School Examinations and Assessment

Cambridge Aligned Curriculum

**CHEMISTRY
BCSE/2202**

Paper II

For examination from 2027

MARK SCHEME

Maximum Mark: 60

Paper II

Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardization scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always whole marks (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded positively:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

GENERIC MARKING PRINCIPLE 5:

Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).

GENERIC MARKING PRINCIPLE 6:

Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

Science-Specific Marking Principles

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| 1 | Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly. |
| 2 | The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored. |
| 3 | Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection). |
| 4 | The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted. |

5 **'List rule' guidance** (see examples below)

For questions that require n responses (e.g. State two reasons ...):

- The response should be read as continuous prose, even when numbered answer spaces are provided
- Any response marked *ignore* in the mark scheme should not count towards n
- Incorrect responses should not be awarded credit but will still count towards n
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should not be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response
- Non-contradictory responses after the first n responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, unless the question states 'show your working'.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

Abbreviations used in the Mark Scheme

/alternative answers for the same marking point underline actual word given must be used by candidate (grammatical variants accepted)
(brackets) the word or phrase in brackets is not required, but sets the context

B marks: These are independent marks, which do not depend on other marks. For a B mark to be awarded, the point to which it refers must be seen specifically in the candidate's answer.

M marks: These are method marks upon which A marks later depend. For an M mark to be awarded, the point to which it refers must be seen specifically in the candidate's answer. If a candidate is not awarded an M mark, then the later A mark cannot be awarded either.

C marks: These are compensatory marks which can be awarded even if the points to which they refer are not written down by the candidate, providing subsequent working gives evidence that they must have known them. For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct working which shows the candidate knew the equation, then the C mark is awarded.

If a correct answer is given to a numerical question, all of the preceding C marks are awarded automatically. It is only necessary to consider each of the C marks in turn when the numerical answer is not correct.

A mark: These are answer marks. They may depend on an M mark or allow a C mark to be awarded by implication.

Examples of how to apply the list rule
State three reasons ... [3]

A

1. Correct	☐	2
2. Correct	☐	
3. Wrong	☐	

B (4 responses)

1. Correct, Correct	☐ , ☐	3
2. Correct	☐	
3. Wrong	ignore	

C (4 responses)

1. Correct	☐	2
2. Correct, Wrong	✓, ☐	
3. Correct	ignore	

D (4 responses)

1. Correct	☐	2
2. Correct, CON (of 2.)	☐ , (discount 2)	
3. Correct	☐	

E (4 responses)

F (4 responses)

1. Correct	☐	2
2. Correct	☐	
3. Correct CON (of 3.)	☐ (discount 3)	

G (5 responses)

1. Correct	☐	3
2. Correct	☐	
3. Correct Correct CON (of 4.)	☐	

H (4 responses)

1. Correct	☐	2
2. Correct	☐	
3. CON (of 2.) Correct	(discount 2) ☐	

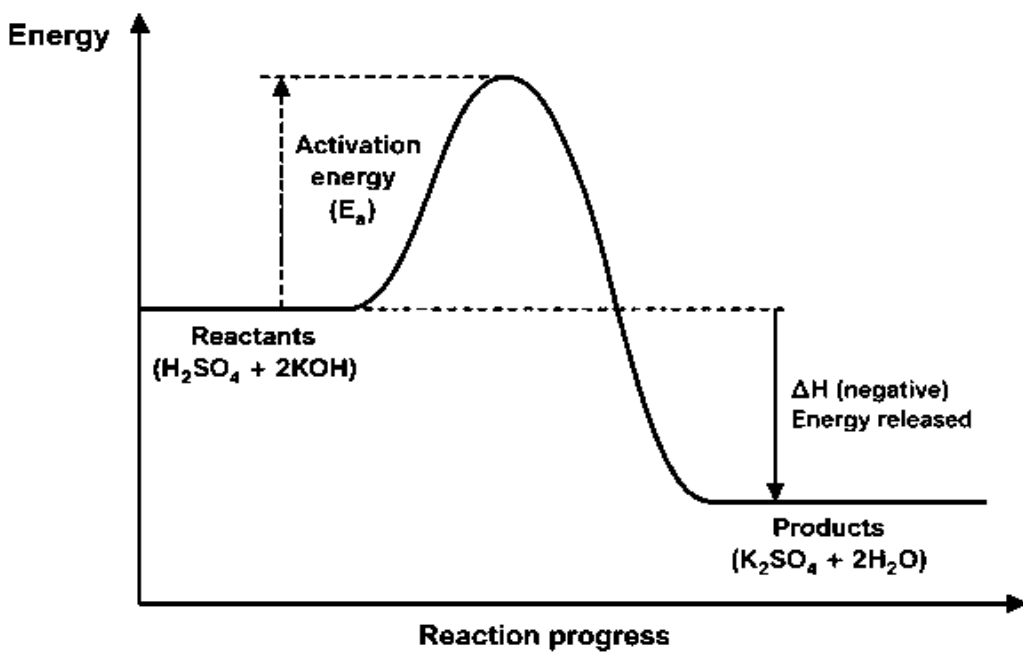
I (4 responses)

1. Correct	✓	2
2. Correct	✗	
3. Correct CON (of 2.)	✓ (discount 2)	

1. Correct	☐	3
2. Correct	☐	
3. Correct, Wrong	☐	

Question I	Answer	Parts	Marks	Guidance
1 a	Atomic size increase down the group 1	1	1	ACCEPT: K has larger atomic size than Na.
	Chlorine has a higher electron affinity than bromine, so it gains an electron more readily	1	2	ACCEPT: Reactivity decreases down the group for halogen/ Atomic size increases down.
	Chlorine forms chloride ions more easily and is more reactive than bromine.	1		
c	Fe or iron	1	1	ACCEPT: finely divided iron
2 a	P: Copper ion or Cu^{2+}	1	2	ACCEPT: copper
	Q: Zinc ion or Zn^{2+}	1		ACCEPT: zinc
b	Zinc hydroxide	1	1	ACCEPT: Zn(OH)_2
c	Grey gelatinous precipitate.	1	1	ACCEPT: Green/ dirty green.
d	Most transition elements or their ions have partially filled d-orbitals.	1	2	ACCEPT incompletely filled d-orbital.
	Electrons absorb certain wavelengths of visible light to move between the d-orbitals, and the remaining light gives the compound its characteristic colour.	1		

Question II	Answer	Parts	Marks	Guidance
1 a	$2\text{KOH}(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{K}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$	2x1=2 (1 mark for each product)	2	IGNORE: Minor formatting differences. REJECT: Incorrect salt (e.g. KHSO_4 , KSO_4). Missing water.
b	Exothermic reaction	1	1	ACCEPT: Heat of neutralization REJECT: "The flask becomes warm."

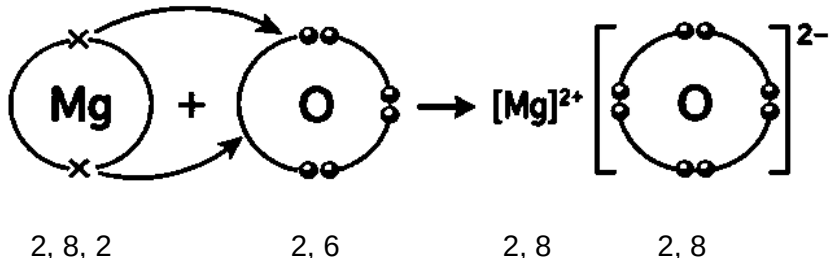
c				1	1	REJECT: Products at a higher energy than the reactants (endothermic profile). No activation energy peak.	
d	Yellow			1	1		
e	The salt formed is potassium sulfate (K_2SO_4). It remains unchanged in air because it is not deliquescent, hygroscopic or efflorescent under normal conditions.			1 1	2	ACCEPT "Stable in air." "Does not absorb moisture." REJECT: It becomes wet. It loses water of crystallization.	
f		Sulphuric acid Completely ionizes in water	Ethanoic acid Partially ionizes in water		1	2	Note: Accept any one of the differences (1 mark)

		Produces a high concentration of H ⁺ ions	Produces a low concentration of H ⁺ ions			
		Conducts electricity better	Conducts electricity less well			
Reason: Sulphuric acid ionises completely because it is a strong acid, whereas ethanoic acid only partially ionises because it is a weak acid.				1		

Question III	Answer	Parts	Marks	Guidance
1 a	—OH	1	1	ACCEPT hydroxyl group REJECT: alcohol or ol
b	C ₂ H ₆ O ₂	1	1	ACCEPT: OHCH ₂ CH ₂ OH or (CH ₂ OH) ₂
c	Ethane-1,2-diol	1	1	ACCEPT 1,2-Ethanediol IGNORE: Minor punctuation differences. REJECT: Ethanol

d	Enzymes-----	1	2	ACCEPT yeast, zymase, maltase.
	25 °C - 30 °C-----	1		Warm temperature about 37 °C or Anaerobic conditions, no oxygen
e	C _n H _{2n-2} -----	1	1	
2 a	$\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{conc. H}_2\text{SO}_4} \text{CH}_3\text{COOCH}_2\text{CH}_3 + \text{H}_2\text{O}$	1 1	2	NOTE: Award 1 mark for CH₃COOCH₂CH₃ and 1 mark for H₂O ACCEPT: Structural formulae. Molecular formulae. IGNORE: Missing reaction conditions. REJECT: Incorrect ester and missing water. Incorrect reactants or Word equation.
b	ethyl ethanoate-----	1	1	IGNORE: Minor spelling errors that do not alter meaning. REJECT: Ester
c	Any one of the following: - Perfumes - Food flavourings	1	1	

	• Solvents -----			
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Question IV	Answer	Parts	Marks	Guidance
1 a	24 grams of Mg $\rightarrow$ 2 mol. of MgO 10 grams of Mg $\rightarrow \frac{2}{24} \times 10 = 0.833$ mol. of MgO	1 1	2	ACCEPT: Accept other methods of calculation that gives the correct answer.
b	Percentage composition of O = $\frac{16}{40} \times 100 = 40\%$	1	1	
c	Gram atomic mass of oxygen = 16 g Gram molecular mass of oxygen = 32 g	1 1	2	REJECT: 16 and 32 or 16 amu and 32 amu.
d	Mg = 2, 8, 2 O = 2, 6	1 1	2	ACCEPT: Mg = $1s^2 2s^2 2p^6 3s^2$ O = $1s^2 2s^2 2p^4$
e	The diagram should show: 		2	ACCEPT: Any other representation that gives the correct representation.

f	Magnesium oxide is an ionic compound as it is formed by complete transfer of electrons from magnesium atom to oxygen atom.	1	2	
	Oxygen exists as covalent molecule as it is formed by mutual sharing of shared pair of electrons between two oxygen atoms.	1		

Question V	Answer	Parts	Marks	Guidance
1 a	Slow reaction-----	1	1	REJECT: Photosynthesis Endothermic reaction
b	Any TWO from the following: • Produces food: Green plants make their own food (glucose) through photosynthesis. This food also provides energy to animals and humans when we eat plants or plant-eating animals. • Releases oxygen: Photosynthesis releases oxygen, which humans and animals need for respiration. • Removes carbon dioxide: Plants take in carbon dioxide (CO₂) from the atmosphere, helping maintain the balance of gases in the air. • Supports food chains: Plants are producers and form the starting point of most food chains and food webs. • Provides useful resources: Plants produce materials such as wood, fruits, vegetables, fibers, and medicines, directly or indirectly supporting human life. • Helps regulate climate: By absorbing carbon dioxide, plants help reduce the buildup of this greenhouse gas in the atmosphere. • Stores solar energy: Photosynthesis converts light energy from the Sun into chemical energy stored in food. This energy ultimately supports many living organisms.	2 x 1	2	Note: Explanation may not be required.
c	$6\text{CO}_2 + 6\text{H}_2\text{O} \xrightarrow[\text{chlorophyll}]{\text{sunlight}} \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ $6(44) + 6(18) = 180 + 6(32)$ $372 \text{ grams} = 372 \text{ grams}$	2x1 =2	2	Note: 1 mark each for correct masses of reactants and products.

Question VI	Answer	Parts	Marks	Guidance
1 a	Hydrogen is included in the activity series as a reference because it behaves like a metal by forming positive ions (H^+). Metals above hydrogen in the activity series can displace hydrogen from dilute acids, while metals below hydrogen cannot.	1	1	REJECT: Hydrogen is a non-metal.
b	The reaction is feasible. Iron is more reactive than copper, so iron displaces copper from copper (II) sulfate solution.	1 1	2	ACCEPT: Iron is above copper in the activity series.
c	Gold and silver are the least reactive metals, so they do not readily react with oxygen, water or other substances.	1	1	ACCEPT: Noble metals/ low reactivity.
d	Electrolysis or electrolytic reduction Sodium is highly reactive and cannot be extracted by reduction with carbon.	1 1	2	ACCEPT: Sodium is highly reactive to combine with reducing agent like carbon to form metal carbide.

