Rewarding Learning

General Certificate of Secondary Education
2022

Double Award Science: Chemistry

Unit C2

Higher Tier

[GDW52]

MONDAY 20 JUNE, MORNING

MARK SCHEME

General Marking Instructions

Introduction

Mark schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of students in schools and colleges.

The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes, therefore, are regarded as part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

COVID-19 Context

Given the unprecedented circumstances presented by the COVID-19 public health crisis, senior examiners, under the instruction of CCEA awarding organisation, are required to train assistant examiners to apply the mark scheme in case of disrupted learning and lost teaching time. The interpretation and intended application of the mark scheme for this examination series will be communicated through the standardising meeting by the Chief or Principal Examiner and will be monitored through the supervision period. This paragraph will apply to examination series in 2021-2022 only

AVAILABLE MARKS

1 **(a)** **(i)**

observation	tick (✓) if correct
a gas is given off which relights a glowing splint	
a gas is given off which "pops" with a lighted splint	✓
no solid remains in the boiling tube	
a white solid remains in the boiling tube	✓
a black solid remains in the boiling tube	

2 correct = [2]; 1 correct = [1]
if 3 ticked – 2 correct + 1 wrong = [1]; 1 correct + 2 wrong = [0] [2]

(ii) $Mg + H_2O \rightarrow MgO + H_2$
LHS or RHS formulae correct = [1]
All formulae correct and balancing correct = [2] [2]

(b) calcium [1]
Because it is the most reactive of the (five) metals [1] [2]

(c) potassium, strontium, aluminium [2] 8
all three correct [2]
two correct [1]
one correct [0]

2 **(a)** argon [1]
carbon dioxide [1] [2]

(b) **(i)** it has a strong triple covalent bond [1]

(ii) Dip a glass rod [1] in **concentrated** hydrochloric acid [1] (and then in a sample of the gas). Idea that white smoke/white fumes is/are formed [1] [3]

(iii) acid [1]

(c) **(i)** Any **two** of:
(surface of the) copper turns black OR black layer/solid (formed) OR black residue
blue-green/green-blue flame
the copper glows red/orange
idea that the copper is initially red-brown
(2 × [1]) [2]

(ii) basic [1]

(iii) $\mathbf{3}Fe + \mathbf{2}O_2 \rightarrow Fe_3O_4$ [1] 11

3 Indicative points

AVAILABLE MARKS

Greenhouse effect (global warming)
- sea levels rise
- flooding/drought/hurricanes/tornados/storms/tropical storms/tsunamis/ extreme weather events/climate change
- melting of ice caps/icebergs
- 2 IPs habitat loss/crop (or vegetation) loss/forest fires/deaths of animals/ bleaching of coral reefs

Max 4IPs

Acid rain
- idea of destroying/damage to buildings/statues/named limestone features/ metals/concrete/gravestones
- destroying/damage to vegetation/defoliating trees
- fish killed (in rivers/lakes) **NOT** oceans/seas

Carbon monoxide release
- is toxic/poisonous
- idea of combining with haemoglobin in the blood/reduces the blood's capacity to carry oxygen

Response	**Marks**
Candidates must use specialist terms throughout, **7–9** indicative points required. They use good spelling, punctuation and grammar and the form and style are of a high standard.	**[5]–[6]**
Candidates use some specialist terms throughout, **4–6** indicative points required. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	**[3]–[4]**
Candidates give **2–3** of the indicative points. They use limited spelling, punctuation and grammar and make little use of specialist terms.	**[1]–[2]**
Response not worthy of credit. Candidates make reference to less than **2** of the points above and offer no other suitable response.	**[0]**

[6] 6

AVAILABLE MARKS

4 **(a)** **(i)** $H_2 + I_2 \rightleftharpoons 2HI$

LHS [1] reversible sign [1] RHS [1]

Balancing – if all formulae correct [1]

If reversible reaction "back to front" with a reversible sign but otherwise completely correct award [3]

If as above but with balancing error award [2] [4]

(ii) explicit idea that (reactants can change into products and) products can change (back) into the reactants. [1]

(b) **(i)** explicit idea that no substances can enter or leave (the system) OR only the reactants and products are present [1]

(ii)

statement	**tick (✓) if correct**
The amounts of products and reactants are equal.	
Both the forward and the reverse reactions stop.	
The amounts of products and reactants remain constant.	✓ **[1]**
The forward and reverse reactions continue at different rates.	
The amount of product increases until no reactants remain.	
The rate of the forward reaction equals the rate of the reverse reaction.	✓ **[1]**

[2] 8

AVAILABLE MARKS

5 **(a)** electrolyte [1]

(b) bauxite [1]

(c) reduces melting point (unless wrongly qualified)/improves electrical conductivity/reduces the operating temperature/saves energy/reduces costs [1]

(d)

	negative electrode	**positive electrode**
observations at the electrode		colourless **[1]** bubbles/gas given off **[1]** (electrode) gets smaller/disappears **[1]** **Max (2 × [1])**
name of electrolysis product	aluminium **[1]**	
half equation for the reaction at the electrode	$Al^{3+} + 3e^- \rightarrow Al$ Al^{3+} on left and arrow and Al on right **[1]** $+e^-$ on left/$-e^-$ on right and correct balancing (NB second mark is dependent on the first) **[1]**	

[5]

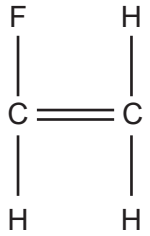
(e) graphite/carbon [1] 9

AVAILABLE MARKS

6 **(a)** $2C_3H_6 + 9O_2 \longrightarrow 6CO_2 + 6H_2O$ OR
$C_3H_6 + 4.5O_2 \longrightarrow 3CO_2 + 3H_2O$
LHS [1] RHS [1] balancing (if all formulae correct) [1] [3]

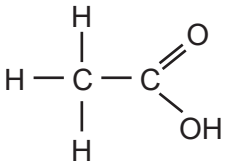
(b) addition [1] polymerisation [1] [2]

(c)



for C=C shown and only one error overall allow [1]
ignore use of brackets [ ] [2]

(d)

name	**molecular formula**	**structural formula**	**physical state at room temperature**
propan-1-ol **[1]**	C_3H_8O *allow* C_3H_7OH **[1]**		
		 **[1]**	liquid **[1]**

[4]

(e) **(i)** any **two** of
fizzing/bubbles/gas given off
gas is colourless
sodium carbonate/(white) solid disappears/dissolves
colourless solution remains
(2 × [1]) [2]

(ii) sodium ethanoate [1] 14

				AVAILABLE MARKS
7	**(a)**	**(i)**	20.2% Up to 2 method marks can be awarded Allow a method mark for showing: $\text{atom economy} = \frac{48}{238^*} \times 100$ *apply ecf If equation correct and answer is 20 or 20.x - where x is not equal to 2 (e.g. 20.1 or 20.17) award second method mark. For 48/Y x100 OR Z/238 x100 apply ecf i.e. up to [2] can be awarded for a correct computation to 1dp. [3]	
		(ii)	Idea of sustainable development/saving resources/less polluting [1] Idea of being cost efficient [1] [2]	
	(b)	**(i)**	0.15 [2] Allow a method mark for a correct computation, e.g. 0.5 × 300 = 150	
		(ii)	Mr/relative formula mass/relative molecular mass (of sulfuric acid) [1]	8
8	**(a)**	**(i)**	A energy/enthalpy [1] B activation energy [1] C energy change/energy released/energy given out [1] D H_2O_2/$2H_2O_2$/hydrogen peroxide/reactant/energy of reactant [1] [4]	
		(ii)	(the energy of) the products is lower than (the energy) of the reactants [1]	
		(iii)	The minimum energy needed/required [1] for reaction to occur [1] [2]	
	(b)		manganese(iv) oxide/manganese dioxide [1]	8
9	**(a)**		Oxidation and reduction are both happening at the same time [1] Carbon dioxide [1] [2]	
	(b)		electrons are gained [1] by the Fe^{3+}/iron ion [1] [2] The “ion” mark depends on the “gaining electrons” mark	
	(c)		the magnesium reacts instead of the iron/magnesium reacts first [1] because magnesium is more reactive than iron [1] hydrated [1] iron(lll) oxide [1] The hydrated mark depends on iron oxide being named [4]	8
			Total	**80**