Rewarding Learning

General Certificate of Secondary Education
2015

GCSE Chemistry

Unit 1

Higher Tier

[GCH12]

TUESDAY 9 JUNE, AFTERNOON

MARK SCHEME

General Marking Instructions and Mark Grids

Introduction
Mark schemes are intended to ensure that the GCSE examination is marked consistently and fairly. The mark schemes provide markers with an indication of the nature and range of candidates' responses likely to be worthy of credit. They also set out the criteria that they should apply in allocating marks to candidates' responses. The mark schemes should be read in conjunction with these marking instructions.

Quality of candidates' responses
In marking the examination papers, examiners should be looking for a quality response reflecting the level of maturity which may reasonably be expected of a 16-year-old which is the age at which the majority of candidates sit their GCSE examinations.

Flexibility in Marking
Mark schemes are not intended to be totally prescriptive. No mark scheme can cover all the responses which candidates may produce. In the event of unanticipated answers, examiners are expected to use their professional judgement to assess the validity of answers. If an answer is particularly problematic, then examiners should seek the guidance of the Supervising Examiner.

Positive Marking
Examiners must be positive in their marking, giving appropriate credit for description, explanation and analysis, using knowledge and understanding and for the appropriate use of evidence and reasoned argument to express and evaluate personal responses, informed insights and differing viewpoints. Examiners should make use of the whole of the available mark range of any particular question and be prepared to award full marks for a response which as good as might reasonably be expected of a 16-year-old GCSE candidate.

Awarding zero marks
Marks should only be awarded for valid responses and no marks should be awarded for an answer which is completely incorrect or inappropriate.

Types of mark scheme
Mark schemes for questions which require candidates to respond in extended written form are marked on the basis of levels of response which take account of the quality of written communication.

Other questions which require only short answers are marked on a point for point basis with marks awarded for each valid piece of information provided.

1 **(a)**

Characteristic of the Scientist's Periodic Table	Name of Scientist
Law of octaves	Newlands [1]
Spaces for undiscovered elements	Mendeleev [1]

[2]

(b) A in hydrogen position [1]
B in lithium position [1]
C in magnesium position [1]
D in mercury position [1] [4]

(c) Q and U [1] both needed
P [1]
T [1]
R [1] [4]

(d) **(i)** $2Na + Cl_2 \rightarrow 2NaCl$
correct formulae of reactants [1]
correct formula of product [1]
correct balancing [1] [3]

(ii) fluorine [1]

(e) **(i)** bromine is less reactive than chlorine [1]

(ii) $2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(iii) displacement (accept redox) [1]

(f) $\frac{(35 \times 3) + (37 \times 1)\,[1]}{4\,[1]} = 35.5\,[1]$ [3]

AVAILABLE MARKS

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AVAILABLE MARKS

2 **(a)** **(i)** ammonia (Do not accept NH_3) [1]

(ii) copper(II) chloride (accept copper chloride)
Do not accept $CuCl_2$ [1]

(iii) limewater [1], changes from colourless [1] to milky [1] [3]

(iv) ammonium sulfate (Do not accept $(NH_4)_2SO_4$) [1]

(v) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
correct formulae of reactants [1]
correct formula of product [1]
correct state symbols [1] [3]

(b) **(i)** $CuCO_3 + 2HNO_3 \rightarrow Cu(NO_3)_2 + CO_2 + H_2O$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(ii) blue [1]

(iii) filtration [1]

(iv) thermometer/temperature probe/measure temperature change/
measure initial and final temperature [1]
increase in temperature [1] [2]

(c) **(i)** positive ion [1]

(ii) **Indicative Content**

- make a solution of the solid
- add sodium hydroxide (solution)
- white precipitate
- add excess sodium hydroxide (solution)
- precipitate does not redissolve confirms magnesium ions present
- add silver nitrate (solution to fresh sample of solution)
- yellow precipitate confirms iodide ions present

Response	Mark
Candidates must use appropriate specialist terms to explain fully the process of confirming the presence of both ions (6–7 points of indicative content). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates must use appropriate specialist terms to explain fully the process of confirming the presence of the ions (using 3–5 points of indicative content). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates explain briefly and partially the process of confirming the presence of the ions (using at least 2 points of indicative content). They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6]

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AVAILABLE MARKS

3 **(a)** Metallic [1] bonding
positive ions and delocalised electrons [1]
attraction between these [1] dependent on second mark [3]

(b) **(i)** $MgCl_2$ [1]

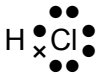
(ii) Correct electronic configuration of magnesium atom
drawn as (2,8,)2 [1]
Correct electronic configuration of two chlorine atoms
drawn as (2,8,)7 [1]

Correct electronic configuration of magnesium ion
drawn as (2,8,) [1]
Correct electronic configuration of two chloride ions
drawn as (2,8,)8
shown as dot and cross [1]

Correct charge on magnesium ion $^{2+}$ [1]
Correct charge on chloride ion $^{-}$ [1] [6]

(c) **(i)** any **two** from the following points:
- conducts electricity when molten or in solution
- soluble in water
- brittle
- high melting point/high boiling point [2]

(ii) any correct ionic compound [1]

(d) 

correct sharing of electrons as dot and cross between H and Cl [1]
all other electrons correct [1]
correct label for a lone pair of electrons [1] [3]

(e) Indicative content

- HCl weak van der Waals forces
- between the molecules
- HCl = little energy required to break (forces)
- $MgCl_2$ = strong bonds
- ionic bonds
- $MgCl_2$ = substantial energy required to break the bonds

Response	Mark
Candidates must use appropriate specialist terms to explain fully the structure and bonding in both compounds (5–6 points of indicative content). They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates must use appropriate specialist terms to explain fully the structure and bonding in both compounds (using 3–4 points of indicative content). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates explain briefly and partially the structure and bonding in these compounds (using at least 2 points of indicative content). They use limited spelling, punctuation and grammar and they have made little use of specialist terms. The form and style are of limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6] 22

4 (a) (i) mass (of solute) [1]
which will saturate [1]
100 **g** of water [1]
at a particular temperature [1]
in the context of a definition
allow **maximum** for the idea of **saturate** [4]

(ii) $(NH_4)_2Cr_2O_7$ [1]

(b) (i) 59 (°C) ±1 [1]

(ii) 22 (°C) ±1 [1]

(iii) water freezes at 0 °C and boils at 100 °C [1]

(c) solubility at 20 °C = 36 [1]/100 g of water (allow ±1)
in 50 g of water = 18 [1] g
mass which crystallises = 30 – 18 = 12 [1] g [3] 11

AVAILABLE MARKS

			AVAILABLE MARKS
5	**(a)**	moles of C = $\frac{20.00}{12}$ = 1.66 [1] moles of H = $\frac{6.66}{1}$ = 6.66 [1] moles of N = $\frac{46.67}{14}$ = 3.33 [1] moles of O = $\frac{26.67}{16}$ = 1.66 [1] empirical formula is CH_4N_2O [1] [5]	
	(b)	moles H_2O_2 = $\frac{5.1}{34\,[1]}$ = 0.15 [1] moles of O_2 = $\frac{0.15}{2}$ = 0.075 [1] mass of O_2 = 0.075 × 32 [1] = 2.4 [1] g [5]	
	(c) **(i)**	contains water **chemically bonded** into the crystal structure [2] contains water in the crystal structure [1]	
	(ii)	$\frac{2 \times 18\,[1]}{96\,[1]}$ × 100 = 37.5 [1] % [3]	
	(iii)	giant covalent/macromolecular [1]	
	(iv)	Moles of Al_2O_3 = $\frac{2.04}{102\,[1]}$ = 0.02 [1] Mass of H_2O = 3.12 – 2.04 = 1.08 [1] g Moles of H_2O = $\frac{1.08}{18\,[1]}$ = 0.06 [1] n = 3 [1] [6]	22
		Total	**100**