Rewarding Learning

General Certificate of Secondary Education
2015–2016

Double Award Science: Chemistry

Unit C1

Higher Tier

[GSD22]

THURSDAY 19 MAY 2016, 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.

1 **(a)**

Contribution	Newlands ***only***	Mendeleev ***only***	***Both*** Newlands and Mendeleev	***Neither*** Newlands or Mendeleev
stated the Law of Octaves	✓ [1]			
arranged elements in order of relative atomic mass			✓ [1]	
included noble gases				✓ [1]
left gaps for undiscovered elements		✓ [1]		

[4]

(b) **(i)** Group 2 [1]

(ii) solid [1]

(iii) diatomic [1]

(iv) 3 electrons in outer shell [1]

(v) metals and non-metals [1]

(c) **(i)** Carbon (accept the symbol C) [1]

(ii) Phosphorus (accept the symbol P) [1] 11

2 **(a)** Li^+ also allow Li^{+1} or Li^{1+} but not li^+ [1]

(b) For any credit the word "mixture" must be given and must not be wrongly qualified; i.e. if mixture not explicit 0 marks, if mixture given but e.g. answer also refers to bonding/joining, etc. then 0 marks.
The only 2 mark answer must communicate the 2 ideas below.
An alloy is a mixture of elements [1] at least one of which is a metal [1]
1 mark answers are:
an alloy is a mixture of metals [1]
a mixture of metals and non-metals [1]
a mixture of metals and elements [1] [2]

(c) Lightness/strength/hardness/durability/resistance to corrosion [1]
Do not credit sturdy/malleable/high melting point and other answers which are correct properties of metals but not relevant to this use.
Mark as wrong answers which refer to conducts electricity/conducts heat
Not rust (ignore if given as a second property) [1] 4

AVAILABLE MARKS

				AVAILABLE MARKS
3	(a)	(i)	Idea that a solvent is a substance in which something (else) dissolves [1] NOT reacts with the solute NOT a solution which dissolves NOT anything can dissolve in it	
		(ii)	the temperature [1] at which a solid changes to a liquid [1] [2] 2 errors [0] marks are independent	
	(b)		Any **two** from: boils at 100 °C – units needed colourless ignore clear/transparent liquid (at RT) odourless density of 1g/cm^3 – units needed tasteless ACCEPT conducts heat or poor heat conductor NOT good heat conductor ACCEPT does not conduct electricity (well) ACCEPT immiscible with oil Reference to pH ignore 2 × [1] [2]	
	(c)		idea that solubility **changes** with temperature. Do not credit “rate” [1]	
	(d)	(i)	A lone pair (of electrons) [1] accept non bonded pair B bonded /shared pair of electrons/bonded pair/shared electrons/ bonded electrons/(single) covalent bond/bond – unless wrongly qualified [1] [2]	
		(ii)	Bonding: covalent [1] Do not credit “molecular” covalent	
		(iii)	carbon dioxide hydrogen sulfide [2]	11

AVAILABLE MARKS

4 Indicative content

- magnesium ion has 12 protons
- oxide ion has 8/magnesium ion has 4 more protons
- magnesium ion has 12 neutrons
- oxide ion has 8 neutrons/magnesium ion has 4 more neutrons than oxide ion
- magnesium ion has the electronic configuration 2,8
- oxide ion has the electronic configuration 2,8
  (for both ions have the same electronic configuration or both ions have 10 electrons unstated allow 1IP instead of 2)
- magnesium ion is formed from its atom by losing electrons
- oxide ion is formed from its atom by gaining electrons
- 2 electrons lost/gained

Response	Mark
Candidates make reference to **7–9** of the main points above to compare and contrast the two ions. They use good spelling, punctuation and grammar and the form and style are of a high standard.	[5]–[6]
Candidates make reference to **4–6** of the main points above to compare and/or contrast the two ions. They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates make reference to **2–3** of the main points above using limited spelling, punctuation and grammar. The form and style are of limited standard and they have made no use of specialist terms.	[1]–[2]
Response not worthy of credit.	[0]

[6] 6

5 (a) copper oxide + sulfuric acid → copper sulfate [1] + water [1] [2]

(b) $2HCl + CuO \rightarrow CuCl_2 + H_2O$ [1]

(c) $CuCO_3 + 2HCl \rightarrow CuCl_2 + H_2O + CO_2$
LHS [1] RHS [1]
[1] balancing – if all formulae correct [3]

(d) $H^+_{(aq)} + OH^-_{(aq)} \rightarrow H_2O_{(l)}$
LHS [1] RHS [1]
state symbols [1] [3] 9

6 CH_4
Correct sharing [1]
correct number of electrons in the valence shell of all five atoms [1]
second mark dependent on first
N_2
correct sharing [1]
correct number of electrons in the valence shell of both N atoms [1]
second mark dependant on first
dot and cross notation correct in both diagrams [1] [5]

AVAILABLE MARKS

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7 **(a)**

Name	Formula	State at room temperature	Colour
bromine	**Br_2**	**liquid** [1]	red-brown
chlorine	**Cl_2**	gas	**green** [1] accept pale green/yellow-green/green-yellow
fluorine	**F_2**	gas	yellow
iodine	**I_2**	**solid** [1]	grey-black

Formulae: All symbols correct [1] all diatomic [1] [5]
Do not credit for incorrect symbols, e.g. Br^-, Cl^-

(b) Increase [1]

(c) 1. All have seven electrons in their outer shell [1]
2. all gain one electron [1]
3. to have a full outer shell/ to be stable [1] max 2 × [1]
marking points 1 and 2 or 2 and 3 will gain max 2 marks [2]

(d) **(i)** $Cl_2 + 2NaI \rightarrow 2NaCl + I_2$
LHS [1] RHS[1]
[1] balancing – if all formulae correct [3]

(ii) chlorine **displaces** iodine/iodine formed [1] NOT iod**ide**
idea that iodine is darker in colour/dark in colour/grey-black/brown (in solution) [1] [2]
For the second marking point answers which suggest that iodine is a reactant gain no credit.

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				AVAILABLE MARKS
8	**(a)**	Electrolysis	[1]	
	(b)	(Oppositely charged) **ions** are free to move [1] and carry the charge/current [1]	[2]	
	(c)	It decomposes/breaks down (accept calcium **and** fluor**ine** formed) NOT separates/splits up/splits into ions/breaks up	[1]	
	(d) **(i)**	The calcium **ions** are positively charged [1] accept it is a cation idea that they are **attracted** to the **negative** cathode/electrode [1]	[2]	
	(ii)	(Each) calcium **ion** [1] gains **2** electrons [1] and is discharged/forms a calcium atom [1] correct equation max [2] $Ca^{2+} + 2e^- \rightarrow Ca$ incorrect equation [0]	[3]	
	(e)	inert/unreactive [1] (very) high melting point [1]	[2]	11
			Total	**70**