Rewarding Learning

General Certificate of Secondary Education
2013

Science: Chemistry

Unit C1

Higher Tier

[GCH12]

MONDAY 10 JUNE, AFTERNOON

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.

					AVAILABLE MARKS
1	(a)	(i)	phosphorus/sulfur/iodine	[1]	
		(ii)	Br	[1]	
		(iii)	hydrogen/nitrogen/oxygen/bromine/iodine	[1]	
		(iv)	hydrogen/nitrogen/oxygen/helium/neon/argon	[1]	
		(v)	iron/copper	[1]	
		(vi)	rubidium	[1]	
		(vii)	argon	[1]	
		(viii)	iodine	[1]	
	(b)	(i)	halogens	[1]	
		(ii)	yellow-green [1] gas [1]	[2]	
		(iii)	toxic	[1]	
	(c)	(i)	$Cl_2 + 2KI \rightarrow 2KCl + I_2$ [1] for correct formulae of reactants [1] for correct formulae of products [1] for correct balancing	[3]	
		(ii)	colourless solution [1] changes to brown [1] grey solid formed [1] Any **two**	[2]	17

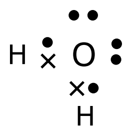
2 (a) (i)

AVAILABLE MARKS

Atom	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons
$^{1}_{1}H$	1	1	1	0	1
$^{16}_{8}O$	8	16	8	8	8

[1] for each row [2]

(ii)



correct sharing of electrons in water [1]
correct number of electrons in total [1]
dot and cross diagram [1] [3]
second and third marks dependent on first

(iii) 20 protons in nucleus [1]
20 neutrons in nucleus [1]
EC drawn 2,8,8 [1] [3]

(b) (i) **mixture** of two or more **elements** [1]
at least one of which is a metal [1] [2]

(ii) different structures/forms of the same element [1]
in the same state [1]
second mark dependent on first [2]

(iii) Indicative content

High melting point:
- strong bonds between (carbon) atoms/in the layers [1]
- indication that these bonds are covalent [1]
- **substantial** energy/heat required to break bonds [1]

Soft:
- layers can slide (off/over each other) [1]
- as there are weak forces of attraction between the layers [1]

Conduct electricity:
- delocalised electrons/free electrons [1]
- can move and carry the charge [1]

Response	Mark
Candidates must use appropriate specialist terms to explain fully the physical properties of graphite using a structural model (**using 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 use some appropriate specialist terms to explain the physical properties of graphite using a structural model (**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 physical properties of graphite using a structural model (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 a limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6]

(c) (i) attraction
between positive ions and delocalised electrons [2] [2]

(ii) layers/(of positive ions) can slide [1]
idea that (metallic) bond is not disrupted [1] [2]

AVAILABLE MARKS: 22

					AVAILABLE MARKS
3	(a)	(i)	thermal [1] decomposition [1]	[2]	
		(ii)	moles of calcium carbonate = $\frac{600}{100[1]}$ = 6 [1]		
			mole ratio $CaCO_3$: CaO = 1:1/moles of calcium oxide = 6 [1]		
			mass of calcium oxide = 6 × 56 [1] = 336 = 336 g [1]	[5]	
	(b)	(i)	to allow air to enter the crucible/to ensure all of the metal reacted	[1]	
		(ii)	(19.36 – 18.34 =) **1.02 g** [1] (1.02/48 =) **0.02125** [1] (20.04 – 19.36 =) **0.680** [1] (0.68/16 =) **0.0425** [1] **ratio = 1:2** [1] empirical formula = TiO_2 [1]	[6]	14

AVAILABLE MARKS

4 **(a)** **(i)** 5–6 points correct [2]
3–4 points correct [1]
1–2 points correct [0]
curve [1] [3]

(ii) there is a temperature increase [1]

(iii) neutralisation [1]

(iv) $NaOH + HCl \rightarrow NaCl + H_2O$
[1] for correct formulae of reactants
[1] for correct formulae of products [2]

(b) **(i)**
- place a measured volume of alkali/KOH into a **conical flask**/ **pipette** alkali/KOH into a **conical flask**/place 25 cm^3 of alkali/ KOH into a conical flask [1]
- add phenolphthalein [1]
- add sulfuric acid from burette [1]
- colour changes from pink to colourless [1]
- note volume of sulfuric acid added **and** repeat without indicator [1] (**alternative**: add charcoal, **heat** and filter)
- **heat to** reduce volume/**heat** to concentrate the solution [1]
- allow to cool and crystallise [1]
- (filter to remove crystals and) dry between filter paper/in a desiccator/low temperature oven [1]

Accept same method with alkali in burette and acid in conical flask
Colour change is ∴ colourless to pink
Maximum [6] [6]

(ii) $2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$
[1] for correct formulae of reactants
[1] for correct formulae of products
[1] for correct balancing [3] 16

					AVAILABLE MARKS
5	**(a)**	**(i)**	mass of solute [1] **or** maximum [1] which will saturate [1] / mass of solute which dissolves in [1] 100 g of water [1] / 100 g of water [1] at a particular temperature [1] / at a particular temperature [1] **in the context of a definition**	[4]	
		(ii)	to remove the solid (which did not dissolve)	[1]	
		(iii)	marks are awarded for recognisable pieces of equipment correctly **labelled** and **assembled** to suit the experiment evaporating basin [1] evaporating basin on gauze on tripod [1] Bunsen burner below gauze/heat and arrow below gauze [1]	[3]	
	(b)	**(i)**	mass of potassium nitrate which would dissolve = 62.5 [1] g mass of potassium nitrate which remains = 72 – 62.5 = 9.5 [1] g	[2]	
		(ii)	solubility at 60°C = 108 [1] g/100 g water solubility at 40°C = 62.5 [1] g/100g water difference in solubility = 108 – 62.5 = 45.5 [1] g solid which crystallises from 500 g water = 45.5 × 5 = 227.5 [1]	[4]	14

6 **(a)** **(i)** hydrogen [1] (ion)
chlor**ide** [1] (ion) [2]

(ii) pH meter [1]
lowest pH is the strongest [1] [2]

(b) **(i)**

	Hydrochloric acid	**Hydrobromic acid**	**Hydroiodic acid**
Observation on adding a few drops of silver nitrate solution.	white ppt	cream ppt	yellow ppt

[1] for each correct colour
[1] for ppt in all 3 boxes [4]

(ii) $Ag^+ + Cl^- \rightarrow AgCl$
[1] for correct formulae of reactants ions including charges
[1] for correct formula of product [2]

(c) **(i)** flame test [1]
yellow [1] flame indicates sodium (ions) present [2]

(ii) add sodium hydroxide (solution) [1]
white ppt [1]
add excess (sodium hydroxide solution) [1]
ppt dissolves/colourless solution formed [1]
validity – aluminium ions give the same result [1] [5]

AVAILABLE MARKS: 17

Total **100**