Rewarding Learning

General Certificate of Secondary Education
2018

GCSE Chemistry

Unit 1

Higher Tier

[GCH12]

WEDNESDAY 13 JUNE, MORNING

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 of 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.

AVAILABLE MARKS

1 (a) **Indicative content**

- Modern Periodic Table has more elements.
- Modern Periodic Table has noble gases, and Mendeleev's table does not
- Modern Periodic Table has no gaps, Mendeleev's table does have gaps for undiscovered elements.
- Modern Periodic Table has a transition metal block, Mendeleev's did not.
- Modern Periodic Table arranges elements in atomic number order, Mendeleev's table used increasing atomic mass.
- Modern Periodic Table has f block/actinides/lanthanides present.

Response	Mark
Candidates must use appropriate specialist terms throughout to fully describe the differences between the modern Periodic Table and Mendeleev's table (using 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 use some appropriate specialist terms to describe the differences between the modern Periodic Table and Mendeleev's table (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 briefly and partially describe some differences between the modern Periodic Table and Mendeleev's table (using 1–2 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]

(b) (i) under oil [1]
to stop it reacting with oxygen/water (vapour) [1] [2]

(ii) Any **two** from:
safety screen [1]
use small piece of lithium [1]
use tongs to lift lithium [1]
large volume of water [1] [2]

(iii) $2Li + 2H_2O \rightarrow 2LiOH + H_2$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

AVAILABLE MARKS

(c) (i)

	State at room temperature	**Colour**
fluorine	gas	yellow
chlorine	gas	**green-yellow/green** [1]
bromine	**liquid** [1]	red-brown
iodine	**solid** [1]	**grey/dark grey/grey-black** [1]

[4]

(ii) $Cl_2 + 2KI \rightarrow I_2 + 2KCl$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(iii) $Cl_2 + 2e^- \rightarrow 2Cl^-$
Cl_2 on left, arrow and Cl^- on right [1]
+ e^- on left [1]
correct balancing [1] [3] 23

2 **(a)** **(i)** completely ionised in solution/water [1]

(ii)

Indicator	Colour with nitric acid	Colour with ammonia solution
blue litmus	red [1]	blue [1]
phenolphthalein	colourless [1]	pink [1]

[4]

(b) **(i)** $NH_3 + HNO_3 \rightarrow NH_4NO_3$
correct formulae of reactants [1]
correct formula of product [1] [2]

(ii) use a thermometer/temperature probe [1]
increase in temperature [1] [2]

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

(ii) limewater [1]

(d) **(i)** $CaCO_3 + 2HNO_3 \rightarrow Ca(NO_3)_2 + H_2O + CO_2$
correct formulae of reactants [1]
correct formulae of products [1]
correct balancing [1] [3]

(ii) **Indicative content**

1. place/measure a volume of nitric acid into a conical flask
2. add calcium carbonate until no more fizzing/in excess/solid remains
3. filter (to remove excess calcium carbonate)
4. heat filtrate to reduce volume
5. allow to cool and crystallise
6. filter to remove crystals
7. dry between two sheets of filter paper/in a low temperature oven/in a desiccator

Response	**Mark**
Candidates must use appropriate specialist terms to describe fully in a logical sequence the preparation of pure dry crystals (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 must use appropriate specialist terms to describe in a logical sequence the preparation of pure dry crystals (using 4–5 points of indicative content). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates describe briefly and partially the preparation of pure dry crystals (using 2–3 points of indicative content). They use limited spelling, punctuation and grammar and they make little use of specialist terms. The form and style are of a limited standard.	[1]–[2]
Response not worthy of credit	[0]

[6]

AVAILABLE MARKS

22

AVAILABLE MARKS

3 **(a)** **(i)** hexagonal rings of carbon atoms (minimum of 3 which tessellate in one layer) [1]
layers [1]
weak forces (of attraction) between layers [1]
covalent bond [1]
labels required are in bold [4]

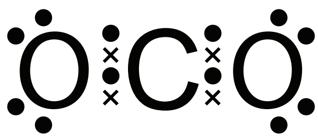
(ii) strong [1] covalent bonds [1]
require substantial energy to break [1] [3]

(b)

Formula of atom or ion	Particle	Number of protons	Number of electrons	Number of neutrons
C	carbon atom	6 [1]	6	6
O^{2-} [1]	oxide ion	8	10 [1]	8
Al^{3+} [1]	aluminium ion [1]	13	10	14

[5]

(c)



[1]

(d) **(i)** layers/lattice [1]
of positive ions [1]
(surrounded by a sea of) delocalised electrons [1]
metallic bond is attraction between positive ions and delocalised electrons [1] [4]

(ii) may be hammered into shape [1]
layers (of positive ions) [1]
can slide over each other [1]
without disrupting the metallic bonds [1] [4]

(iii) low density [1] 22

					AVAILABLE MARKS
4	(a)	(i)	unsaturated [1] **136** $<$144 **or 680** $<$720 [1]	[2]	
		(ii)	solubility at 30 °C = 152 g/100g H_2O 4 × 4 = 16 g extra dissolved per 100 g H_2O [1] 152 + 16 = 168 [1] g/100 g H_2O temperature = 50 [1] °C	[3]	
		(iii)	colourless	[1]	
	(b)		dip nichrome wire [1] into concentrated hydrochloric acid [1] and dip in sample and place in a blue Bunsen flame [1] lilac [1] flame	[4]	
	(c)	(i)	dissolve sample in water/make a solution [1] add silver nitrate (solution) [1] yellow ppt [1]	[3]	
		(ii)	$Ag^+ + I^- \rightarrow AgI$ correct formulae of reactant ions [1] correct formula of product [1]	[2]	15

				AVAILABLE MARKS
5	**(a)**	**(i)** mass of the atom compared with that of the carbon 12 isotope [1] which has a mass of exactly 12 [1]	[2]	
		(ii) FeC_4O_4	[1]	
		(iii) $FeSO_4.7H_2O$	[1]	
		(iv) % water = $\frac{7 \times 18\ [1]}{278\ [1]} \times 100 = \frac{126}{278} \times 100 = 45.3\%$ [1]	[3]	
	(b)	**(i)** moles of haematite = $\frac{16\,000\,000\ [1]}{160\ [1]} = 100\,000$ [1] moles of Fe = 200 000 [1] mass of iron = 200 000 × 56 [1] = (11 200 000 g) = 11.2 tonnes [1]	[6]	
		(ii) % yield = $\frac{10.2}{11.2} \times 100$ [1] = 91.1 [1] %	[2]	
	(c)	moles of iron = $\frac{46.5}{56} = 0.83$ [1] moles of sulfur = $\frac{53.5}{32} = 1.67$ [1] formula FeS_2 [1]	[3]	18
			Total	**100**