New Specification

Rewarding Learning

General Certificate of Secondary Education
2012

Science: Chemistry

Unit C1

Higher Tier

[GCH12]

TUESDAY 12 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 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.

Section A

AVAILABLE MARKS

1 **(a)** **(i)** Method 3/distillation [1]

(ii) Method 2/filtration/filtering [1]

(iii) idea that copper sulfate is soluble [1]

(iv) **A** = filtrate [1]
B = distillate [1] [2]

(b) **(i)** blue (ink) [1]

(ii) blue (ink) [1]

(iii) yellow and blue (inks) [1]

(iv) liquid in which the solute/dyes/components dissolve [1]

(v) green (ink) [1] 10

2 **(a)** **(i)** sharing of electrons [1]
idea of a pair of electrons [1] (2nd mark dependent on first) [2]

(ii)

[1] for shared pair shown as × and ●
[1] for 1 electron in outer shell of H atom
[1] for 7 electrons in outer shell of Cl atom [3]
second and third marks only awarded if first mark awarded for correct sharing of electrons
Award 2 marks for correct bonding diagram if not dot and cross

(iii) Van der Waals forces [1]

(b) **(i)** strong bonds [1]
substantial **energy** required to break [1] [2]

(ii) structure: ionic lattice/giant ionic [1]
evidence: conducts electricity when in solution or when molten [1]
high melting point/soluble in water [1] [3]

(iii) ions [1]
(are free to) move and carry charge [1] [2] 13

AVAILABLE MARKS

3 (a)

Group number	Name of group	Number of electrons in outer shell of atom
1	alkali metals [1]	1 [1]
2	alkaline earth metals [1]	2 [1]

[4]

(b) (i) electronic configuration of K 2, 8, 8, 1 [1]
electronic configuration of K^+ 2, 8, 8 [1]
The K^+ ion is more stable because it has a full outer shell [1] [3]

(ii) $2K + Cl_2 \rightarrow 2KCl$
[1] for correct formulae of reactants
[1] for correct formula of product
[1] for correct balancing (only awarded if all formulae are correct) [3]

(c) Indicative content

- both groups give same products with water
- hydrogen and (metal) hydroxide
- Group 1 are more reactive (with water) than Group 2
- all of the Group 1 elements react/not all Group 2 react/Be is the **only** one which does not react
- idea that both groups have same trend in reactivity down group
- statement of trend in reactivity

Accept alternative appropriate responses

Response	Mark
Candidates must use appropriate specialist terms throughout to compare and contrast the reaction of Group 1 elements with water with the reaction of Group 2 elements with water (at least 5 points from above). 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 compare and contrast the reaction of Group 1 elements with water with the reaction of Group 2 elements with water (at least 3 points from above). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates attempt to compare and contrast the reaction of Group 1 elements with water with the reaction of Group 2 elements with water (at least 1 point from above). 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]

16

				AVAILABLE MARKS
4	(a)	(i)	RFM of $MgCO_3$ = 84 [1] moles of $MgCO_3$ = $\frac{2.1}{84}$ = 0.025 [1] 1:1 so moles of $MgSO_4$ = 0.025 [1] RFM of $MgSO_4$ = 120 [1] mass of $MgSO_4$ = 0.025 × 120 = 3 [1] g [5]	
		(ii)	% = $\frac{1.8}{3}$ ×100 [1] = 60 [1] % [2]	
		(iii)	any **one** from: loss by mechanical transfer loss when fizzing loss by filtration incorrect measurements side reactions reaction not complete [1]	
	(b)	(i)	heat to constant mass/to ensure **all** the water (of crystallisation) had been removed [1]	
		(ii)	13.96 – 13.33 = 0.63 [1] g [1]	
		(iii)	RFM of water = 18 [1] moles of water = $\frac{0.63}{18}$ = 0.035 [1] [2]	
		(iv)	13.33 – 12.73 = 0.6 (g) [1]	
		(v)	0.6/120 = 0.005 [1]	
		(vi)	0.005 : 0.035 [1] 1 : 7/moles of water of crystallisation = 7 [1] [2]	16

AVAILABLE MARKS

5 (a) (i) Indicative content

- place hydrochloric acid in a suitable container
- add calcium carbonate
- stir/swirl/heat/warm
- until no further reaction occurs/no more reacts/no more fizzing/**excess** solid remaining
- filter (the reaction mixture)
- remove excess calcium carbonate/ filtrate is calcium chloride solution

Accept alternative appropriate responses

Response	Mark
Candidates must use appropriate specialist terms throughout to discuss fully the preparation of a solution of calcium chloride from calcium carbonate and hydrochloric acid in a logical sequence ([5]–[6]). 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 discuss the preparation of a solution of calcium chloride from calcium carbonate and hydrochloric acid in a logical sequence ([3]–[4]). They use satisfactory spelling, punctuation and grammar and the form and style are of a satisfactory standard.	[3]–[4]
Candidates describe the preparation of a solution of calcium chloride from calcium carbonate and hydrochloric acid which may not be in a logical sequence ([1]–[2]). They use limited spelling, punctuation and grammar and form and style are of a limited standard.	[1]–[2]
Response not worthy of credit.	[0]

[6]

(ii) $CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$
[1] for correct formulae of reactants
[1] for correct formulae of products
[1] for correct balancing (only awarded if all formulae correct) [3]

(iii) heat to concentrate/to half volume [1]
allow to (cool and) crystallise [1]
filter the crystals [1]
dry between two sheets of filter paper/in a desiccator/in a low temperature oven [1] maximum [3]

				AVAILABLE MARKS
(b)	**(i)**	$H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$ [1] for correct formulae of reactants [1] for correct formula of product [1] for correct state symbols	[3]	
	(ii)	pink [1] to colourless [1] award [1] if wrong way round	[2]	
	(iii)	limewater	[1]	
	(iv)	burette	[1]	
(c)	**(i)**	compare to a colour chart	[1]	
	(ii)	red litmus is red with neutral solutions	[1]	
	(iii)	pH metre/pH = 1.82 and a pH range of 0–2 means a strong acid [1] red with universal indicator red indicates a strong acid [1]	[2]	23
6	**(a)**	nichrome wire/flame test rod [1] dipped in conc HCl/deionised water **and** dip wire/rod into solid sample [1] into Bunsen flame and observe the colour [1]	[3]	
(b)	**(i)**	sodium	[1]	
	(ii)	aluminium [1] zinc [1]	[2]	
	(iii)	SO_4^{2-}	[1]	
	(iv)	any **two** from: sodium sulfate zinc sulfate aluminium sulfate	[2]	
	(v)	$Ba^{2+} + SO_4^{2-} \rightarrow BaSO_4$ [1] for correct formulae of reactants [1] for correct formula of product	[2]	11

				AVAILABLE MARKS
7	**(a)**	mass [1] of solute which will saturate [1] 100 g of water [1] at a given temperature [1] allow idea of **maximum which dissolves** for saturate	[4]	
	(b) **(i)**	40 (°C)	[1]	
	(ii)	solubility at 70 °C = 134 [1] (g/100 g water) solubility at 20 °C = 32 [1] (g/100g water) 134 – 32 = 102 [1] g $\frac{102}{2}$ = 51 [1] g	[4]	
	(c)	dissolved oxygen content decreases [1] aquatic life dies [1]	[2]	11
			Total	**100**