Rewarding Learning

General Certificate of Secondary Education
2014

GCSE Chemistry

Unit 1

Higher Tier

[GCH12]

TUESDAY 10 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)** **(i)** using a pH meter/limited range pH paper [1]

(ii) colourless [1]

(iii) 3 (minutes) [1]

(b) **(i)** completely ionised in water/solution allow has a pH of 0–2 [1]

(ii) $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$
[1] for correct formulae of reactants including charges
[1] for correct formula of product
[1] for correct state symbols (3rd mark dependent on 1st 2 marks) [3]

(iii) $CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$
[1] for correct formulae of reactants
[1] for correct formulae of products
[1] for correct balancing (3rd mark dependent on 1st 2 marks) [3]

(iv) limewater [1] allow calcium hydroxide (solution)
changes from colourless [1] to milky [1] [3]

(c) **(i)** (a compound/substance) formed when (some or all of) the hydrogen ions [1] in an acid [1] are replaced with metal ions (other positive ions/ammonium ions) [1]
allow – formed when an acid reacts with base/carbonate/alkali or formed in a neutralisation reaction max [1] [3]

(ii) make a solution of the solid [1]
add silver nitrate solution [1]
white ppte [1] [3]

AVAILABLE MARKS

(d) Indicative content

- calcium chloride formed in both
- water is other product in reaction of calcium hydroxide with hydrochloric acid
- hydrogen is other product in reaction of calcium with hydrochloric acid
- observations for calcium hydroxide and hydrochloric acid – test tube gets warm/heat (released)/solution remains colourless (any incorrect extra observation loses this mark)
- observations for calcium and hydrochloric acid – any **two** from:
  - bubbles/effervescence/gas produced
  - test tube gets warm/heat (released)
  - solid disappears
  - colourless solution formed

Response	**Mark**
Candidates must use appropriate specialist terms throughout to fully compare and contrast these two reactions (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 compare and contrast these two reactions (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 compare and contrast these two reactions (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]

AVAILABLE MARKS

25

AVAILABLE MARKS

2 **(a)** **(i)**

Group number	Name of group	Number of electrons in the outer shell of an atom
1	alkali metals [1]	1 [1]

[2]

(ii) reactivity increases going down the group [1]

(iii) Any **three** from:
- floats/on surface
- moves around
- fizzing
- lilac flame
- metal disappears
- colourless solution forms
- heat released
- crackles/small explosion/sparks [3]

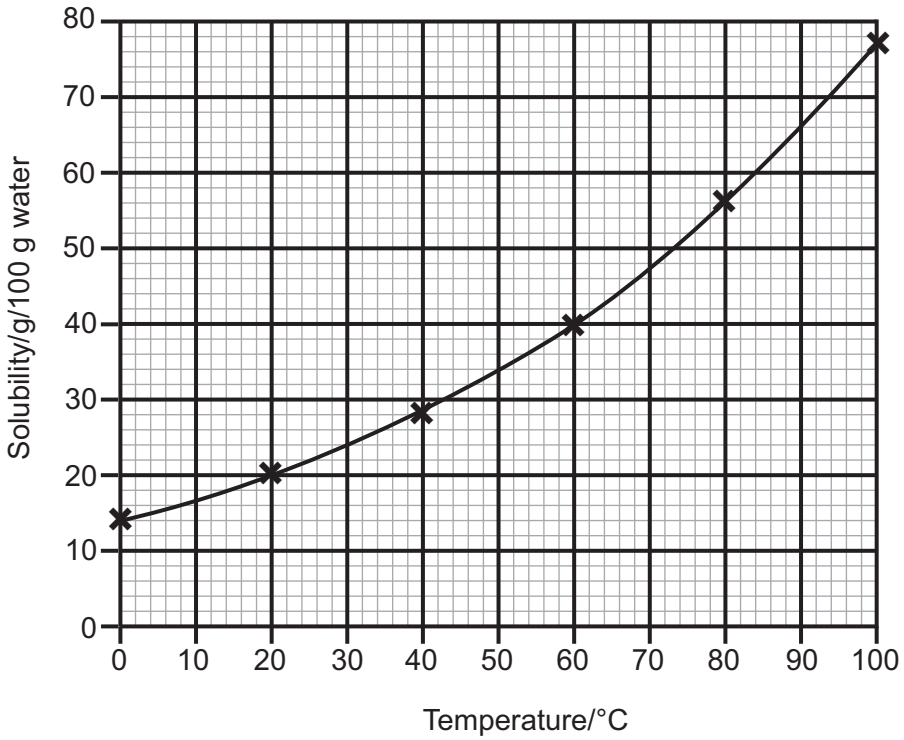
(b) **Indicative content**
- 2,8,8,1 for K atom
- 2,8,8 for K^+
- $K \rightarrow K^+ + e^-$ [2] $K \rightarrow K^+$ [1] electron mark dependent on 1st mark
- K^+ full outer shell/has a noble gas configuration
- K^+ more stable (than K)/idea of relative stability

Response	Mark
Candidates must use appropriate specialist terms throughout to compare a potassium atom and a potassium ion (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 compare a potassium atom and a potassium ion (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 compare a potassium atom and a potassium ion (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]

(c) Mass Spectrometry [1]
High Performance Liquid Chromatography/HPLC [1] [2]

14

				AVAILABLE MARKS
3	(a)	(i)	**contains** water of crystallisation [1]	
		(ii)	blue [1]	
		(iii)	no more solute **will dissolve**/no more solid will dissolve [1]	
	(b)	(i)	mass [1] which will saturate [1] 100 g of water [1] at a particular temperature [1] allow maximum for idea of saturate [4]	
		(ii)	 5–6 points plotted correctly = [2] 3–4 points plotted correctly = [1] 1–2 points plotted correctly = [0] smooth curve [1] [3]	
	(c)	(i)	solubility at 70 °C = 47 [1] g/100 g water allow ± 2 in 10 g of water = 4.7 [1] g apply consequential marking from graph [2]	
		(ii)	solubility at 75 °C = 52 [1] g/100 g water allow ± 2 solubility at 45 °C = 31 [1] g/100 g water allow ± 2 difference in solubility = 52 – 31 = 21 [1] for 200 g 21 × 2 = 42 [1] g apply consequential marking from graph [4]	16

4 **(a)** plum pudding = positive sphere [1] with electrons embedded in it [1]
today's model = nucleus containing protons and neutrons [1]
electrons (orbiting) in shells/energy levels/orbits/electrons orbiting around the nucleus [1] [4]

(b) **(i)** 15 [1]

(ii) 31 [1]

(iii) nucleus [1]

(iv) diagram showing 2,8,5 [1]

(c)

Atom/Ion	Number of protons	Electronic configuration
N [1]	7	2,5
O^{2-}	8 [1]	2,8 [1]
Al^{3+}	13 [1]	2,8 [1]
Mg^{2+} [1]	12	2,8

[6]

(d) **(i)** potassium sulfide/lithium oxide [1]

(ii) aluminium/iron [1]

(iii) graphite/diamond [1]

(iv) carbon dioxide/iodine/water allow graphite [1]

(v) carbon dioxide [1]

(vi) aluminium/graphite/iron [1]

(e) carbon [1]

(f) **(i)** [1] for correct sharing of electrons (3 bonded pairs)
[1] for correct number of electrons and e^- in a lone pair
[1] for correct bonding diagram not shown as × and •
each mark dependent on the one before [3]

(ii) $N_2 + 3H_2 \rightarrow 2NH_3$
[1] for correct formulae of reactants
[1] for correct formula of product
[1] for correct balancing [3]

(iii) [1] for correct sharing of electrons
[1] for correct number of e^-/N e^- as a lone pair
[1] for a correct bonding diagram not shown as × and •
each mark dependent on the one before [3]

AVAILABLE MARKS

30

					AVAILABLE MARKS
5	**(a)**	**(i)**	$C_{21}H_{22}N_2O_2$	[1]	
		(ii)	element = carbon [1] mass = 12 [1]	[2]	
		(iii)	toxic/poisonous	[1]	
	(b)	**(i)**	Bunsen burner/HEAT in correct position [1] tripod and pipeclay triangle [1] crucible without lid [1] No labels = [0]	[3]	
		(ii)	$\frac{5.53}{158\ [1]} = 0.035$ [1] moles of $KMnO_4$ moles of $O_2 = \frac{0.035}{2} = 0.0175$ [1] mass of $O_2 = 0.0175 \times 32$ [1] = 0.56 [1] g	[5]	
		(iii)	oxygen/gas [1] released (to the surroundings) [1] 2nd mark dependent on first	[2]	
		(iv)	5.53 – 0.56 = 4.97	[1]	15
				Total	**100**