



Rewarding Learning

General Certificate of Secondary Education
2016

Centre Number

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Candidate Number

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GCSE Chemistry

Unit 1

Foundation Tier



GCH11

[GCH11]

WEDNESDAY 15 JUNE, AFTERNOON

TIME

1 hour 15 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.

You must answer the questions in the spaces provided.

Do not write outside the boxed area on each page or on blank pages.

Complete in blue or black ink only. **Do not write with a gel pen.**

Answer **all five** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 80.

Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in Question **3(a)(ii)**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

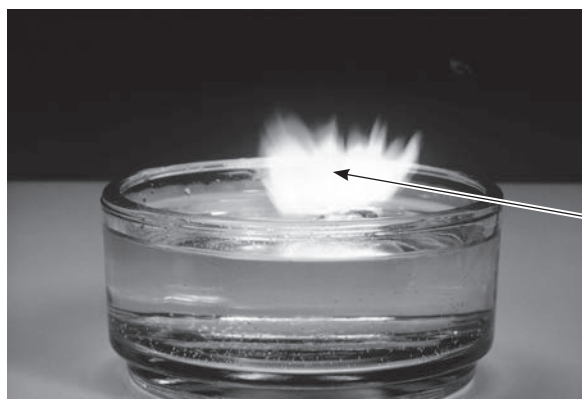
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24GCH1101

1 Group 1 and 2 elements show a variety of physical and chemical properties.

(a) The picture below shows a Group 1 element reacting with water. A lilac flame is observed.



lilac flame

© E. R. Degginger / Science Photo Library

(i) State four **other** observations for this reaction.

1. _____
2. _____
3. _____
4. _____ [4]

(ii) Name the Group 1 element which is reacting with water.

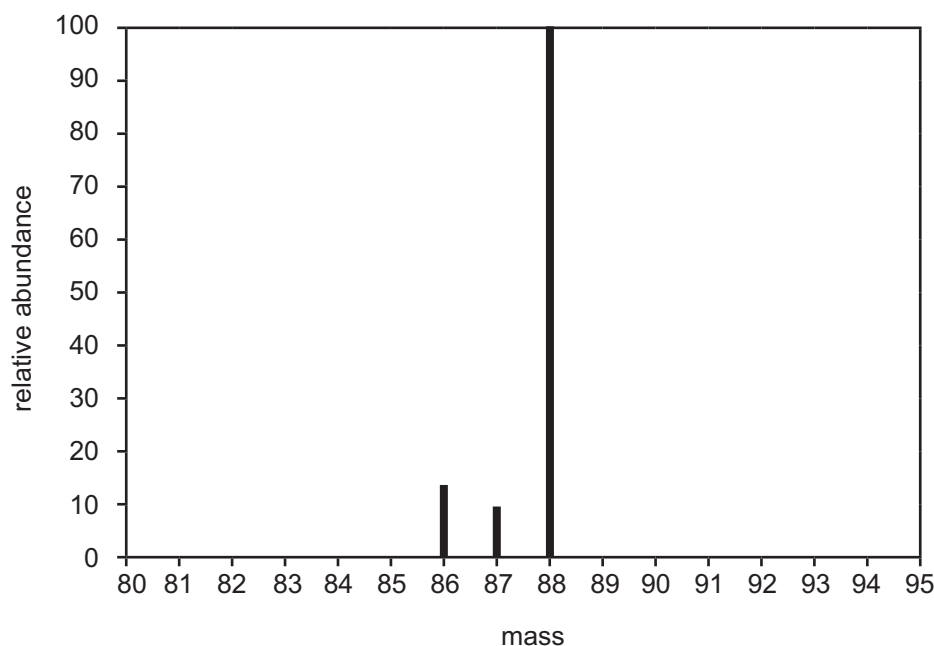
_____ [1]

(iii) Name the **two** products of the reaction of this Group 1 element with water.

_____ [2]



- (b) The diagram below shows part of a mass spectrum of a sample of a Group 2 element. Each peak in the spectrum represents an isotope of this element.



- (i) What is meant by the term isotope?

_____ [2]

- (ii) Based on the mass spectrum above, how many isotopes of the element are present in the sample?

_____ [1]

- (iii) What is the mass of the isotope with the greatest relative abundance?

_____ [1]

- (iv) Suggest the identity of the Group 2 element using your Data Leaflet.

_____ [1]

[Turn over



(v) Suggest one advantage of using mass spectrometry to analyse elements.

[1]

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2 Solutions may be classified as acidic, alkaline or neutral using the pH scale.

(a) (i) Name an indicator which may be used to find the pH value of a solution.

_____ [1]

(ii) Complete the following table.

Name of Compound	Formula	pH value
	H_2SO_4	
Water	H_2O	
	CH_3COOH	3

[4]

(b) Hydrochloric acid reacts with zinc metal to produce a salt and hydrogen gas.

(i) Name the salt produced in this reaction.

_____ [1]

(ii) Describe the chemical test for hydrogen gas and state the result for a positive test.

 _____ [2]



(c) An excess of hydrochloric acid can build up in the stomach and cause indigestion. Antacid tablets containing calcium carbonate can be taken to relieve the symptoms of indigestion.

(i) State the observations made when an antacid tablet containing calcium carbonate is dropped into a beaker of dilute hydrochloric acid.

[3]

(ii) Write a balanced symbol equation for the reaction between calcium carbonate and hydrochloric acid.

[3]



(d) Other brands of antacid tablets contain aluminium hydroxide.

(i) Write the formula of aluminium hydroxide.

_____ [1]

(ii) State the colour of aluminium hydroxide.

_____ [1]

(iii) Describe what is observed when sodium hydroxide solution is added until it is in excess to a solution containing aluminium ions.

_____ [3]



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- 3 The Shard in London is 309 metres high and is currently the tallest building in the European Union. It is the fifty-ninth tallest building in the world.



© chrisdorney / iStock / Thinkstock

- (a) In the construction of the Shard, 12 000 tonnes of steel were used. Steel is an alloy of carbon and iron. One form of carbon is graphite.

- (i) What is meant by the term alloy?

[2]



- the name of the type of bonding,
- the name of the type of structure,
- a description of the structure of graphite.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

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[6]

10000

[Turn over



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(b) There are 11 468 panels of glass in the Shard, enough to cover eight football pitches. The glass is made from silicon dioxide, sodium oxide, calcium oxide and small amounts of other compounds, including iron(II) oxide.

(i) What type of bonding is found in silicon dioxide?

_____ [1]

(ii) What type of bonding is found in sodium oxide?

_____ [1]

(iii) Using full electronic configurations, draw **dot and cross** diagrams to show how atoms of calcium combine with atoms of oxygen to form calcium oxide. Include the charge on each ion.

[6]



- (c) The glass used in the Shard is 'low iron glass' which is very clear. Any iron(II) oxide impurity in the glass would produce a tint.

(i) What is the formula of iron(II) oxide?

_____ [1]

- (ii) Iron(II) oxide contains the iron(II) ion. Complete the table below by giving the number of protons, neutrons and electrons present in an atom of iron and an iron(II) ion.

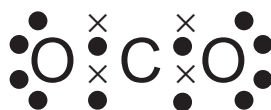
Atom or ion	Atomic number	Mass number	Number of protons	Number of electrons	Number of neutrons
Fe	26	56			
Fe ²⁺	26	56			

[3]



- (d) The Shard uses energy saving methods to generate heat and so its carbon dioxide emissions are reduced.

A **dot and cross** diagram for the bonding in carbon dioxide is shown below.



- (i) What is the formula for carbon dioxide?

_____ [1]

- (ii) What type of bonding is found in carbon dioxide?

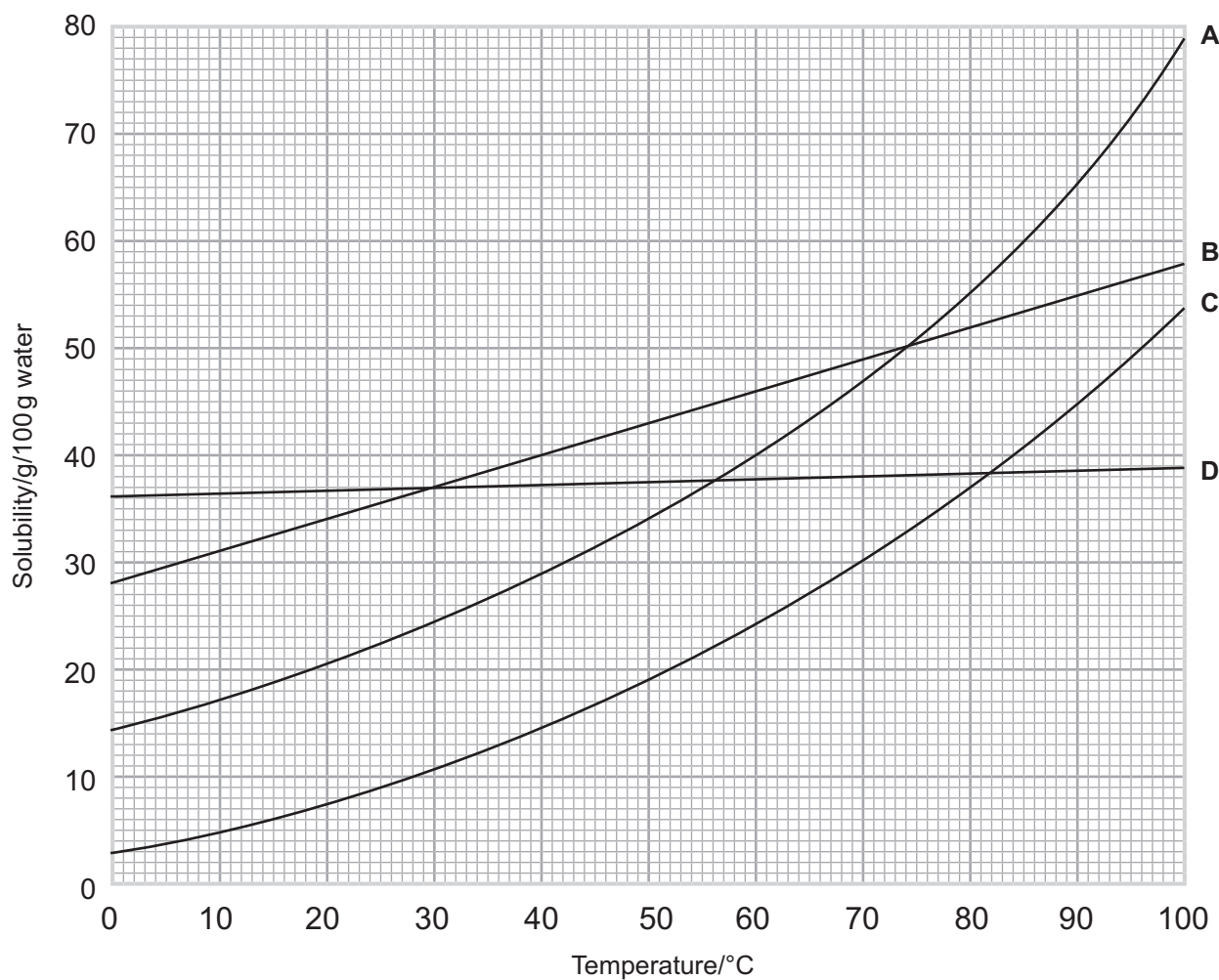
_____ [1]

- (iii) Draw a circle around a lone pair in the dot and cross diagram for carbon dioxide.

[1]



- (c) The graph below shows the solubility curves for four different substances, A, B, C and D.



- (i) Which substance (A, B, C or D) is most soluble at 10 °C?

_____ [1]

- (ii) Which substance (A, B, C or D) is least soluble at 90 °C?

_____ [1]



(iii) At what temperature do substances A and D have the same solubility?

_____ [1]

(iv) At what temperature would 3 g of substance C saturate 10 g of water?

Temperature _____ °C [1]



5 Seawater contains a range of dissolved salts.

(a) (i) Complete the table below for some of the salts present in seawater.

Name of Salt	Formula	Relative Formula Mass
	MgCl_2	
Sodium sulfate	Na_2SO_4	

[3]

(ii) The most abundant salt present in seawater is sodium chloride, NaCl . Calculate the number of moles of sodium chloride in 29.25 kg.

(Relative atomic masses: $\text{Na} = 23$; $\text{Cl} = 35.5$)

Moles of $\text{NaCl} =$ _____ [3]

(iii) Sodium chloride may be obtained by reacting sodium hydroxide with hydrochloric acid.

Write a balanced symbol equation for this reaction.

_____ [2]



- (b) Magnesium chloride has healing effects on a wide range of diseases. The hydrated form of magnesium chloride contains water of crystallisation and has the formula $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$.

- (i) What is meant by the term water of crystallisation?

_____ [1]

- (ii) Calculate the relative formula mass of hydrated magnesium chloride, $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$.

(Relative atomic masses: H = 1; O = 16; Mg = 24; Cl = 35.5)

Relative formula mass = _____ [1]

- (iii) Use the value calculated in (b)(ii) to find the percentage of water of crystallisation in hydrated magnesium chloride.

Percentage of water = _____ % [2]

[Turn over



- (iv) Describe how water of crystallisation may be removed from hydrated salts and how you would ensure that all of the water of crystallisation has been removed.

[2]

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For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	

Total Marks	
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Examiner Number

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SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

DATA LEAFLET

For the use of candidates taking
 Science: Chemistry,
 Science: Double Award
 or Science: Single Award

Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations.

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble

Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

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chemistry double award single award





THE PERIODIC TABLE OF ELEMENTS
Group

Rewarding Learning

1

2

3

4

5

6

7

0

1

H

Hydrogen

1

7

Li

Lithium

3

9

Be

Beryllium

4

23

Na

Sodium

11

24

Mg

Magnesium

12

39

K

Potassium

19

40

Ca

Calcium

20

45

Sc

Scandium

21

48

Ti

Titanium

22

51

V

Vanadium

23

52

Cr

Chromium

24

55

Mn

Manganese

25

56

Fe

Iron

26

59

Co

Cobalt

27

59

Ni

Nickel

28

64

Cu

Copper

29

65

Zn

Zinc

30

70

Ga

Gallium

31

73

Ge

Germanium

32

75

As

Arsenic

33

79

Se

Selenium

34

80

Br

Bromine

35

84

Kr

Krypton

36

85

Rb

Rubidium

37

88

Sr

Strontium

38

89

Y

Yttrium

39

91

Zr

Zirconium

40

93

Nb

Niobium

41

96

Mo

Molybdenum

42

99

Tc

Technetium

43

101

Ru

Ruthenium

44

103

Rh

Rhodium

45

106

Pd

Palladium

46

108

Ag

Silver

47

112

Cd

Cadmium

48

115

In

Indium

49

119

Sn

Tin

50

122

Sb

Antimony

51

128

Te

Tellurium

52

127

I

Iodine

53

131

Xe

Xenon

54

133

Cs

Caesium

55

137

Ba

Barium

56

139

La^{*}

Lanthanum

57

178

Hf

Hafnium

72

181

Ta

Tantalum

73

184

W

Tungsten

74

186

Re

Rhenium

75

190

Os

Osmium

76

192

Ir

Iridium

77

195

Pt

Platinum

78

197

Au

Gold

79

201

Hg

Mercury

80

204

Tl

Thallium

81

207

Pb

Lead

82

209

Bi

Bismuth

83

210

Po

Polonium

84

210

At

Astatine

85

222

Rn

Radon

86

223

Fr

Francium

87

226

Ra

Radium

88

227

Ac[†]

Actinium

89

261

Rf

Rutherfordium

104

262

Db

Dubnium

105

263

Sg

Seaborgium

106

262

Bh

Bohrium

107

265

Hs

Hassium

108

266

Mt

Meitnerium

109

269

Ds

Darmstadtium

110

272

Rg

Roentgenium

111

285

Cn

Copernicium

112

140	Ce Cerium 58	141	Pr Praseodymium 59	144	Nd Neodymium 60	147	Pm Promethium 61	150	Sm Samarium 62	152	Eu Europium 63	157	Gd Gadolinium 64	159	Tb Terbium 65	162	Dy Dysprosium 66	165	Ho Holmium 67	167	Er Erbium 68	169	Tm Thulium 69	173	Yb Ytterbium 70	175	Lu Lutetium 71
232	Th Thorium 90	231	Pa Protactinium 91	238	U Uranium 92	237	Np Neptunium 93	242	Pu Plutonium 94	243	Am Americium 95	247	Cm Curium 96	245	Bk Berkelium 97	251	Cf Californium 98	254	Es Einsteinium 99	253	Fm Fermium 100	256	Md Mendelevium 101	254	No Nobelium 102	257	Lr Lawrencium 103

* 58 – 71 Lanthanum series
† 90 – 103 Actinium series

a	x
b	

a = relative atomic mass (approx)
x = atomic symbol
b = atomic number