



Rewarding Learning

General Certificate of Secondary Education
2017–2018

Centre Number

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Candidate Number

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Double Award Science: Chemistry

Unit C1
Higher Tier

[GDW22]

THURSDAY 22 FEBRUARY 2018, MORNING



TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

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

Write your answers in the spaces provided in this question paper.

Answer **all eight** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 70.

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

A Data Leaflet including a Periodic Table of the elements is provided.

Quality of written communication will be assessed in Question **4(a)**.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	

Total Marks	
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1 This question is about atomic structure.

(a) Use your knowledge of atomic structure to complete the table below.

Atom/ion	Mass number	Number of protons	Number of neutrons	Number of electrons
Atom P	19		10	9
Atom Q	38	18		18
Ion R		8	8	10
Ion S	40		20	18
Atom T	63	29	34	

[5]

(b) Atom Q is one of a number of **isotopes** of that element.

What is meant by the term **isotope**?

_____ [1]

Examiner Only	
Marks	Remark
○	○

2 Read the information about elements **Q** and **R** and then answer the questions that follow.

- Q has an electronic configuration of 2,8,8,1
- R has an electronic configuration of 2,6
- Q forms an ionic bond with R

(a) (i) How many electrons are transferred from an atom of element Q when it bonds with element R?

_____ [1]

(ii) How many electrons does an atom of element R need in order to become stable?

_____ [1]

(iii) Write a formula **using the symbols Q and R** for the compound formed when they bond ionically.

_____ [1]

(b) Ionic bonding involves cations and anions.

(i) What is an **anion**?

_____ [1]

(ii) Write a half equation for the formation of a chloride ion from a chlorine atom.

_____ [1]

Examiner Only	
Marks	Remark
○	○

3 The table below gives information about four gold alloys.

Alloy	Percentage Gold	Percentage Other metals	Price/g	Relative hardness
9 carat gold	37.5%	62.5%	£11.60	170
14 carat gold	58.3%		£18.10	160
18 carat gold	75%	25%	£23.20	200
22 carat gold	91.67%	8.33%	£28.30	75

(a) Complete the table by calculating the percentage of other metals present in 14 carat gold.

_____ % [1]

(b) Suggest why 18 carat gold is a very good choice for making jewellery and why 9 carat gold is often used instead.

[3]

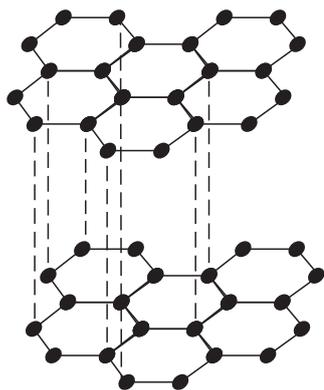
(c) Explain, with reference to the table, why 9, 14, 18 and 22 carat gold can each be described as a formulation.

[3]

Examiner Only	
Marks	Remark
○	○

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(Questions continue overleaf)

4 (a) The diagrams below show two structural models.



Structure A



Structure B

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Both of these structures represent allotropes of carbon. Their structures mean that A and B have particular physical properties. The uses of A and B relate to their structures and properties.

Demonstrate your understanding of the above paragraph by:

- Explaining the meaning of the term “allotrope” and giving the names of the allotropes represented by Structure A and Structure B.
- Explaining why the allotrope with Structure A conducts electricity and why it can be used in pencils.
- Explaining why the allotrope with Structure B has a very high melting point and why it can be used in cutting tools.

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

Explain the meaning of the term “allotrope” and the names of the allotropes A and B:

Examiner Only	
Marks	Remark
○	○

Explain why allotrope A conducts electricity and why it can be used in pencils:

Explain why allotrope B has a very high melting point and why it can be used in cutting tools:

[6]

(b) Graphene, another allotrope of carbon, was first discovered in 2004. It is an exciting new material that has some very special properties.

(i) Describe the structure of graphene.

[2]

(ii) What property of graphene means that it can be used in batteries?

[1]

(iii) Graphene is about 300 times stronger than steel. Explain why graphene is so strong.

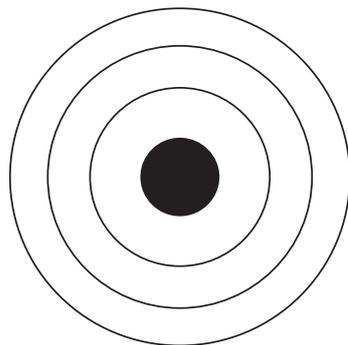
[1]

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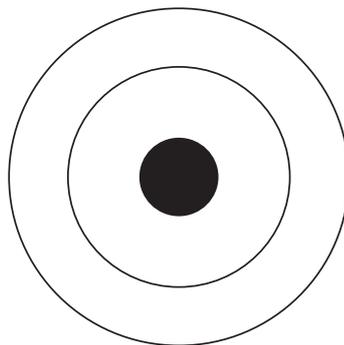
Marks Remark

5 (a) Oxygen reacts with sodium to form the compound sodium oxide.

(i) Complete the diagrams below to show **all** the electrons in a sodium atom and an oxygen atom.



sodium atom



oxygen atom

[2]

(ii) Write the electronic configurations of a sodium ion and of an oxide ion.

sodium ion: _____

oxide ion: _____ [2]

(iii) Sodium ions can be identified using a flame test.
What is the flame colour of a sodium ion?
Circle the correct answer.

crimson **lilac** **brick red** **yellow/orange** **white**

[1]

Examiner Only	
Marks	Remark
○	○

- (b) (i) In the space below draw a dot and cross diagram to show the bonding in water H_2O . Only outer electrons are needed.

[3]

- (ii) How many lone pairs of electrons are there in a water molecule?

[1]

Examiner Only	
Marks	Remark

6 This question is about relative formula masses, moles and the percentage of an element by mass in a compound.

(a) Calculate the relative formula mass of each of the following substances.

(relative atomic masses: H = 1, N = 14, O = 16, S = 32, K = 39)

(i) potassium nitrate KNO_3

_____ [1]

(ii) ammonium sulfate $(\text{NH}_4)_2\text{SO}_4$

_____ [1]

(b) The relative formula mass of ammonium nitrate, NH_4NO_3 is 80.

(i) What is the mass of 0.60 moles of ammonium nitrate?

_____ g [1]

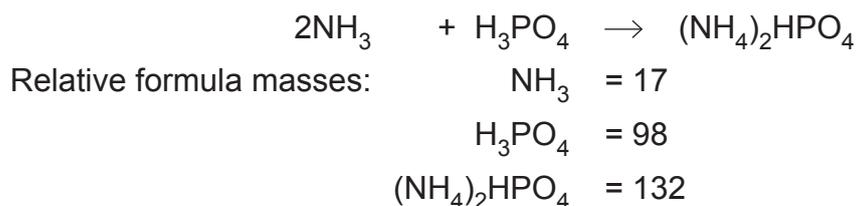
(ii) Ammonium nitrate is used as a fertiliser because it has a high nitrogen content.

Calculate the percentage of nitrogen, by mass, in ammonium nitrate, NH_4NO_3 .

_____ % [3]

Examiner Only	
Marks	Remark
○	○

- (c) The fertiliser diammonium phosphate can be made from ammonia and phosphoric acid. The overall equation can be represented as:



- (i) What is the minimum mass of ammonia needed to make 660 g of diammonium phosphate?

Show your working out.

_____ g [3]

- (ii) In a laboratory experiment a chemist used the correct amounts of ammonia and phosphoric acid to give a theoretical yield of 660 g of diammonium phosphate but the actual yield was 561 g.

Calculate the percentage yield in this experiment.

_____ % [2]

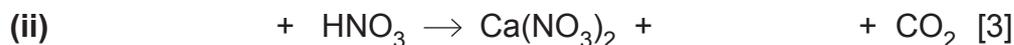
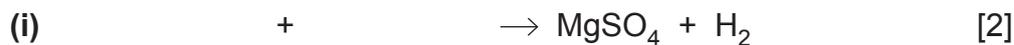
- (iii) Give one reason why the actual yield of diammonium phosphate was less than 100%.

_____ [1]

Examiner Only	
Marks	Remark

7 Acids react with bases, alkalis, carbonates and metals to produce salts.

(a) Complete and balance the equations below.



(b) Describe a test to identify the carbon dioxide gas produced in equation (ii).

 _____ [2]

(c) **Name** the ion which is always produced when alkalis dissolve in water.

_____ [1]

(d) Write an **ionic** equation, with state symbols, to describe neutralisation.

_____ [3]

(e) Carbonic acid is described as a weak acid. Explain in terms of ions what this means.

 _____ [2]

(f) What are the units of concentration for acids?

_____ [1]

Examiner Only	
Marks	Remark
○	○

- 8 The table below gives information on some reactions of the halogens with solutions of halides.

halogen	with potassium chloride solution	with potassium bromide solution	with potassium iodide solution
bromine	no reaction		colourless to dark brown
iodine	no reaction	no reaction	
chlorine		colourless to orange /brown	colourless to dark brown

- (a) Name the type of reaction that takes place when chlorine is bubbled through potassium iodide solution.

_____ [1]

- (b) Explain why there is no reaction between iodine and potassium chloride solution.

_____ [2]

- (c) Write a balanced symbol equation for the reaction between fluorine and potassium bromide.

_____ [3]

- (d) Why do the halogens have similar chemical properties?

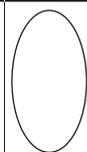
_____ [1]

THIS IS THE END OF THE QUESTION PAPER

Examiner Only

Marks

Remark



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will be happy to rectify any omissions of acknowledgement in future if notified.



New
Specification

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
Butanoate	$\text{C}_3\text{H}_7\text{COO}^-$
Carbonate	CO_3^{2-}
Dichromate	$\text{Cr}_2\text{O}_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogencarbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	HCOO^-
Nitrate	NO_3^-
Propanoate	$\text{C}_2\text{H}_5\text{COO}^-$
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

Data Leaflet

Including the Periodic Table of the Elements

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

gcse examinations chemistry

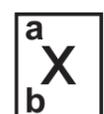
THE PERIODIC TABLE OF ELEMENTS

Group

																		0
																		4
																		He Helium
1	2											3	4	5	6	7		
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10	
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18	
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	98 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	266 Sg Seaborgium 106	264 Bh Bohrium 107	277 Hs Hassium 108	268 Mt Meitnerium 109	271 Ds Darmstadtium 110	272 Rg Roentgenium 111	285 Cn Copernicium 112							

* 58 – 71 Lanthanum series

† 90 – 103 Actinium series



a = relative atomic mass (approx)

x = atomic symbol

b = atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	145 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