



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

MV18

[GDW22]

THURSDAY 17 MAY 2018, MORNING

Time

1 hour, plus your additional time allowance.

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 on blank pages.

Complete in black ink only. Answer **all ten** questions.

Information for Candidates

The total mark for this paper is 70.

Figures in brackets printed at the end of each question indicate the marks awarded to each question or part question.

Quality of written communication will be assessed in

Question **4(b)**.

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

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1 Transition elements form ions with different charges.**(a)** Iron can form iron(II) oxide and iron(III) oxide.

Which one of the following statements would you expect to be correct?

Put a tick in the correct box. [1 mark]

Both these oxides of iron are white solids

Both these oxides of iron are coloured solids

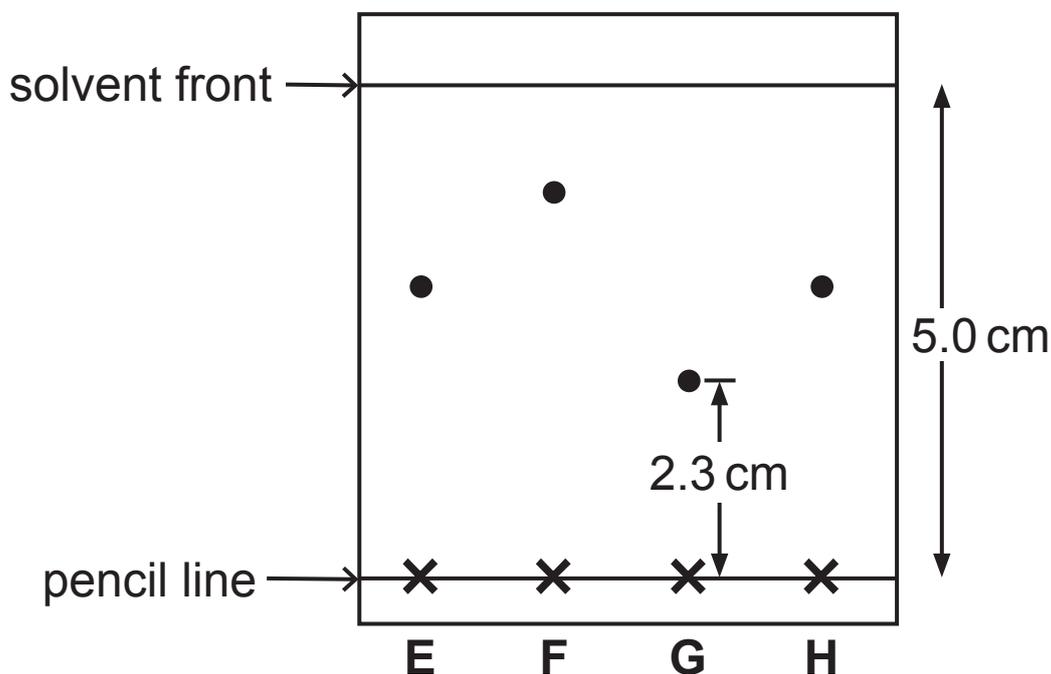
One of the oxides is a white solid and the other is a coloured solid

(b) (i) Describe how you would carry out a flame test to identify the copper(II) ions in copper(II) chloride powder. [4 marks]

(ii) What is the flame colour for copper(II) ions?
[1 mark]

(b) Four green dyes (E, F, G and H) were investigated using chromatography.

The chromatogram is shown below:



The dyes can be identified by calculating the R_f value for a particular solvent.

Calculate the R_f value for dye **G**.

Show your working out. [2 marks]

R_f value: _____

- 3 Read the article below which is about nanoparticles in sun creams and answer the questions that follow.

Today many sun creams use nanoparticles. These sun creams are very good at absorbing ultraviolet radiation which can be harmful to the skin.

Due to their particle size, these sun creams spread more easily, and cover the skin better which also saves money because less is needed. They are also transparent, unlike the more traditional sun creams which are white.

Nanoparticles of titanium oxide are used in some sun creams. Normal sized particles of titanium oxide are also used.

It is thought that nanoparticles can pass through the skin and travel more easily around the body than normal sized particles. This could result in the possibility that they could be toxic to some types of cells such as skin, bone, brain and liver cells.

- (a) How many atoms are in a typical nanoparticle?

Circle the correct answer. [1 mark]

a few

a few hundred

a few million

a few billion

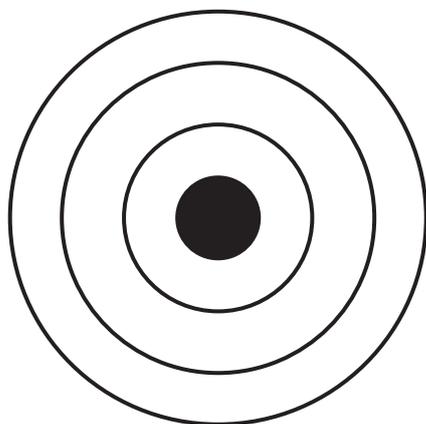
(b) Apart from cost, give three advantages of using sun creams which contain nanoparticles. [3 marks]

1. _____
2. _____
3. _____

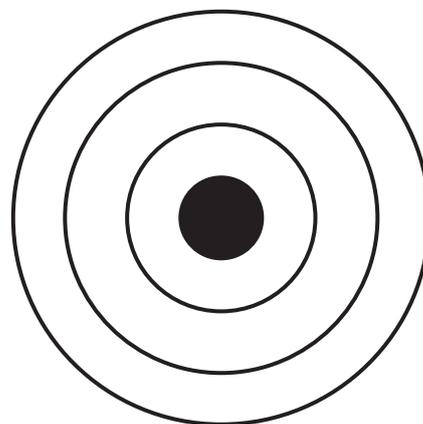
(c) Why might using sun creams which contain nanoparticles pose a risk to the body? [2 marks]

4 Sodium reacts with sulfur to form a compound called sodium sulfide.

(a) Complete the diagrams below to show the electronic structures of:



a sodium **atom**



a sulfur **atom**

[2 marks]

5 This question is about covalent bonding.

(a) Complete the three sentences below by adding the missing words: [5 marks]

Covalent bonding is typical of _____ elements and compounds.

Covalent bonds are strong and _____ amounts of _____ are needed to break them.

Forces between covalent molecules are _____ and are called _____ forces.

(b) Draw a dot and cross diagram to show the bonding in carbon dioxide, CO_2 . Show the outer electrons only. [3 marks]

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(Questions continue overleaf)

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

(a) Complete the sentence below to define the term **relative atomic mass**. [3 marks]

The relative atomic mass (A_r) of an atom is the _____

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

(relative atomic masses:

C = 12, N = 14, O = 16, Mg = 24, Ca = 40)

(i) calcium carbonate, CaCO_3 [1 mark]

(ii) magnesium nitrate, $\text{Mg}(\text{NO}_3)_2$ [1 mark]

(c) The relative formula mass of ethane, C_2H_6 , is 30.

(i) Calculate the number of moles in 150 g of ethane.
[1 mark]

_____ g

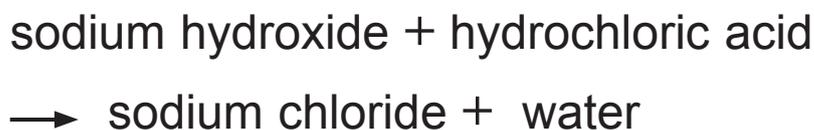
(ii) Calculate the percentage of carbon, by mass, in ethane, C_2H_6 .

Show your working out. [3 marks]

- 7 (a) The table below gives information about the salts formed when three bases react with acids. Complete the table by filling in all the gaps. [2 marks]

Base	Acid	Formula of cation in salt	Formula of anion in salt	Formula of salt produced
calcium hydroxide	hydrochloric acid		Cl^-	CaCl_2
	sulfuric acid	Cu^{2+}		CuSO_4
sodium hydroxide	nitric acid	Na^+	NO_3^-	

- (b) A word equation is given below:



Use this equation to help write an **ionic** equation to show the formation of sodium chloride. [2 marks]

- (c) What happens to the pH of an acidic solution if the concentration of the hydrogen ions increases?
 [1 mark]

(d) A strong acid like nitric acid (HNO_3) is completely ionised in water.

What does this mean? [2 marks]

You may use words and/or an equation in your answer.

- 8 The table below gives information about the physical properties of four substances (A, B, C and D). Use the information to help you answer the questions which follow.

Substance	Melting point/ $^{\circ}\text{C}$	Boiling point/ $^{\circ}\text{C}$	Electrical conductivity when solid	Electrical conductivity when molten
A	808	1465	poor	good
B	3650	4200	good	good
C	660	2500	good	good
D	-182	-161	poor	poor

- (a) Which substance (A, B, C or D) has a molecular covalent structure? Explain your choice. [2 marks]

Substance with a molecular covalent structure:

Explanation: _____

- (b) Which substance (A, B, C or D) is made up of oppositely charged ions in a giant lattice structure? Explain your choice. [2 marks]

Substance made up of oppositely charged ions in a giant lattice structure:

Explanation: _____

(c) Which substance (A, B, C or D) could be graphite?
Explain your choice. [2 marks]

Substance which could be graphite:

Explanation: _____

(d) Which substance (A, B, C or D) is a metal with a relatively low melting point?
Explain your choice. [2 marks]

Substance which is a metal: _____

Explanation: _____

9 Gallium is an element with atoms which have different mass numbers.

(a) Use the information in the table to calculate the relative atomic mass of gallium to one decimal place.

Show your working out. [2 marks]

Mass Number	Abundance
69	60%
71	40%

Answer _____

(b) Explain, in terms of atomic structure, why some atoms of gallium are heavier than others. [2 marks]

10 (a) When chlorine gas is bubbled into sodium iodide solution, it causes a chemical reaction which results in a colour change in the solution.

(i) Write a balanced symbol equation for this reaction.
[3 marks]

(ii) Describe the colour change in the solution.
[2 marks]

The colour changes from _____ to

(iii) What is displaced in the reaction between chlorine and sodium iodide? [1 mark]

(b) When bromine is added to sodium iodide solution a similar reaction occurs to that of chlorine with sodium iodide solution.

Explain why **chlorine** and **bromine** react in similar ways. [2 marks]

THIS IS THE END OF THE QUESTION PAPER

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

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
Butanoate	C ₃ H ₇ COO ⁻
Carbonate	CO ₃ ²⁻
Dichromate	Cr ₂ O ₇ ²⁻
Ethanoate	CH ₃ COO ⁻
Hydrogencarbonate	HCO ₃ ⁻
Hydroxide	OH ⁻
Methanoate	HCOO ⁻
Nitrate	NO ₃ ⁻
Propanoate	C ₂ H ₅ COO ⁻
Sulfate	SO ₄ ²⁻
Sulfite	SO ₃ ²⁻

New
Specification

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

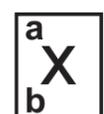
THE PERIODIC TABLE OF ELEMENTS

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