



Rewarding Learning

General Certificate of Secondary Education
2023–2024

Centre Number

--	--	--	--	--

Candidate Number

--	--	--	--	--

Single Award Science: Chemistry

Unit 2

Foundation Tier



[GSA21]

GSA21

WEDNESDAY 22 MAY 2024, MORNING

TIME

1 hour.

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 black ink only. **Do not write with a gel pen.**

Answer **all ten** questions.

INFORMATION FOR CANDIDATES

The total mark for this paper is 60.

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 **10**.

A Data Leaflet, which includes a Periodic Table of the Elements, is included for your use.



- 1 (a) In schools, containers of chemicals have symbols on them to warn students of the dangers.

- (i) What name is given to these symbols?

Circle your answer.

hazard

security

universal

safety

[1]

- (ii) Apart from warning of danger, give **one** reason why symbols are used instead of words.

[1]

- (b) Use lines to match each symbol to the danger.

Symbol

Danger



corrosive



explosive



toxic

[2]



2 (a) The table below gives information about some acids and alkalis.

(i) Complete the table.

Choose from:

red 4 alkali 11 neutral
acid 7 orange

Solution	pH	Colour with universal indicator	Acid/alkali/neutral
lemon juice	4		acid
baking powder	9	blue	alkali
tea	6	yellow	
water		green	neutral

[3]

(ii) Acid is the main cause of tooth decay. Explain why some toothpastes contain baking powder.

_____ [1]

(b) Give **one** advantage of using a pH meter instead of universal indicator to measure pH.

_____ [1]

[Turn over



- 3 The fingerprint below was collected from a white surface at a crime scene.



- (a) Name the type of fingerprint pattern shown above.

_____ [1]

- (b) Given below are the steps a scientist might use to take a fingerprint from a surface at a crime scene.
They are **not** in the correct order.

1. Brush off excess powder.
2. Sprinkle a powder onto the surface.
3. Transfer the fingerprint onto card.
4. Lift the fingerprint with clear tape.

- (i) Put the steps **1**, **2**, **3** and **4** in the correct order.

_____ [2]

- (ii) Name **one** powder that can be used to visualise fingerprints on a **white** surface.

_____ [1]



(c) Give **one** reason why fingerprints are useful in helping to identify a suspect.

_____ [1]

(d) Give **one** other use of fingerprints.

_____ [1]

[Turn over



- 4 (a) The table below shows the amount of different types of waste **recycled** in Northern Ireland in 2019.

Type of waste	Amount recycled/tonnes
cans	1200
paper	21 400
electrical goods	4000
green waste	44 000
other waste	20 200
glass	
Total	96 800

- (i) Calculate the amount of glass recycled in 2019.

Show your working out.

_____ tonnes [2]

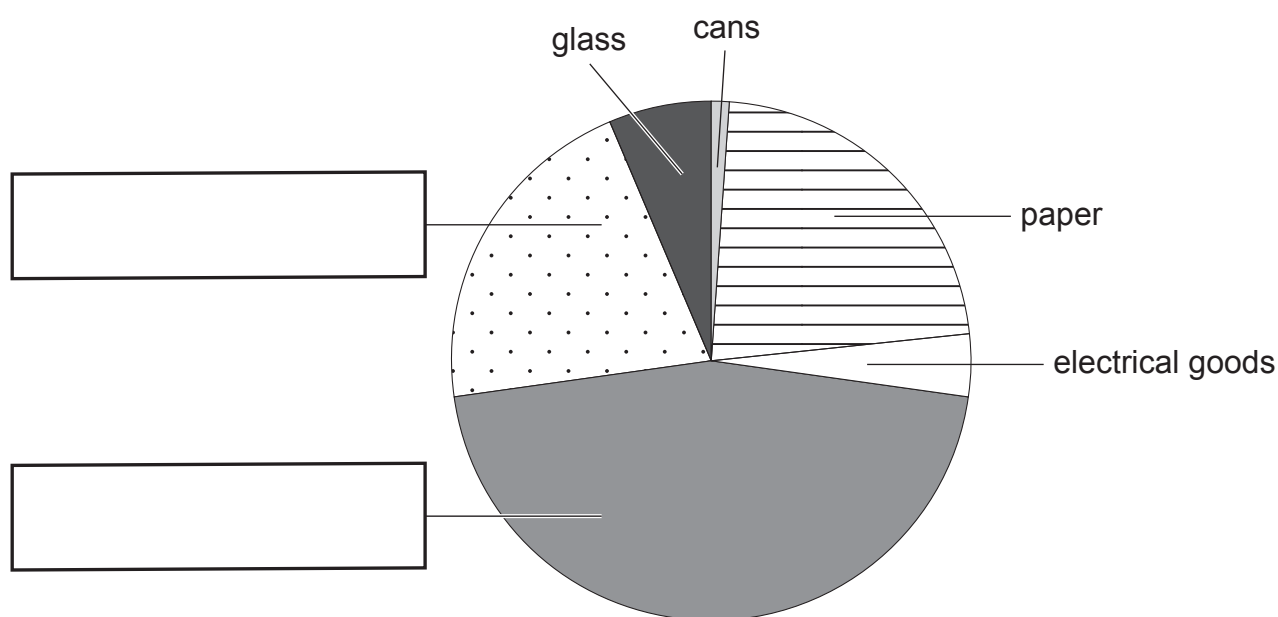
The total amount of waste **produced** in Northern Ireland in 2019 was 200 000 tonnes. The government needed to recycle **half** of this total to meet their target.

- (ii) Calculate by how much they were under this target.

_____ tonnes [1]



(iii) Use information from the table opposite to complete the labels on the pie chart below.



[1]

One benefit of recycling is that it reduces the use of landfill sites.

(b) Give **one** reason why reducing the use of landfill sites is important.

[1]

[Turn over

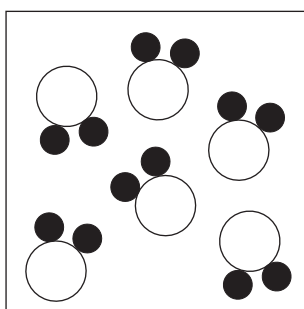


5 Chemicals can be elements, compounds or mixtures.

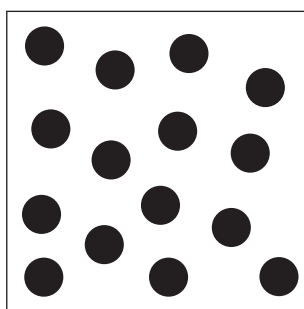
(a) What is meant by the term **mixture**?

[2]

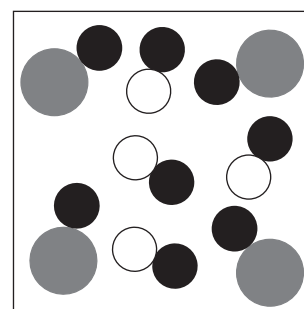
Particle diagrams can be used to represent elements, compounds and mixtures.



A



B



C

(b) Which diagram **A**, **B** or **C** represents:

a pure element? _____

a pure compound? _____

[2]

(c) Complete the table below by placing **one** tick (✓) in each row to show if the chemical is an element, compound or mixture.

The first one has been done for you.

Chemical	Element	Compound	Mixture
lithium	✓		
helium			
ammonia			

[2]



(d) What is the formula of the compound copper(II) sulfate?

Circle your answer.



[1]

(e) The compound potassium hydrogencarbonate has the formula KHCO_3 .

(i) How many elements are present in KHCO_3 ?

_____ [1]

(ii) How many atoms are represented by the formula KHCO_3 ?

_____ [1]



6 Below is an outline of the modern Periodic Table.

The letters **A**, **B**, **C**, **D** and **E** represent the positions of some elements.

[illegible]

(a) Which element **A**, **B**, **C**, **D** or **E** is:

the most reactive metal? _____

a gas? _____

an alkaline earth metal? _____

[3]

(b) Complete the following sentences about the development of the Periodic Table.

In 1869, the Russian scientist Dmitri _____ put

all the known elements into a periodic table. He placed them in order of

atomic _____

[2]

(c) Why were the noble gases **not** included in the Russian scientist's periodic table?

[1]



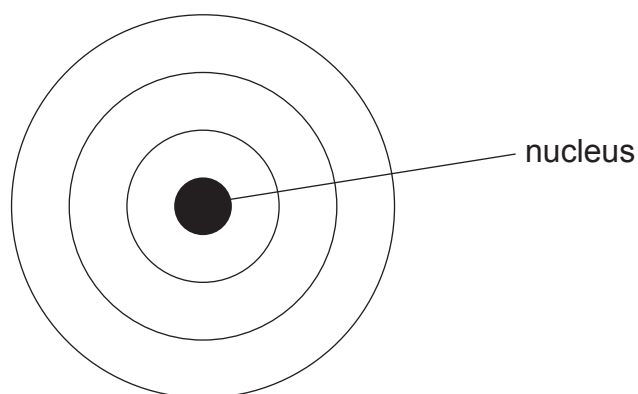
7 The table below gives some information about the elements sodium and aluminium.

(a) Complete the table.

Element	Atomic number	Mass number	Number of		
			protons	neutrons	electrons
sodium	11	23	11	12	
aluminium	13	27	13		13

[2]

(b) Complete the diagram below to show the electronic structure of **aluminium**.



[1]

(c) Describe how an aluminium **ion** is formed from an atom of aluminium.

[2]

[Turn over



- 8 (a) Nanotechnology can be used to create clothing with enhanced features such as UV protection and anti-odour properties. It can also be used to create clothing that is more environmentally friendly.

Nano-titanium dioxide adds sun protection to clothing just as it does in sun creams. Nano-silver is woven into fabric to give it anti-bacterial properties, killing the bacteria that make clothes smell due to sweat.

While scientists studying nanomaterials think they have the potential to change the way we live, there are also some concerns about their use.

Use this information and your knowledge to answer the following questions.

- (i) Give **one** advantage of using nano-silver in clothing. Explain your answer.

[2]

- (ii) Give **one** advantage of using nanoparticles in sun creams.

[1]

- (iii) Why are some scientists concerned about the use of nanomaterials?

[1]



(b) Shown below is a baby bottle made from a smart material.



This smart material is a plastic that changes colour from blue to red when hot liquid is added.

(i) What name is given to this type of smart material?

_____ [1]

(ii) Suggest why using this type of smart material makes the bottle safer when feeding a baby.

_____ [1]

[Turn over



9 (a) The table below gives information about four hydrocarbons.

Hydrocarbon	Number of carbon atoms	Melting point/°C	Boiling point/°C
methane	1	−182.0	−161.0
ethane	2	−183.0	−88.0
propane	3	−188.0	−42.0
butane	4	−138.0	−0.5

(i) Name the hydrocarbon with the highest **melting** point.

_____ [1]

(ii) Describe the trend in **boiling** point as the number of carbon atoms changes.

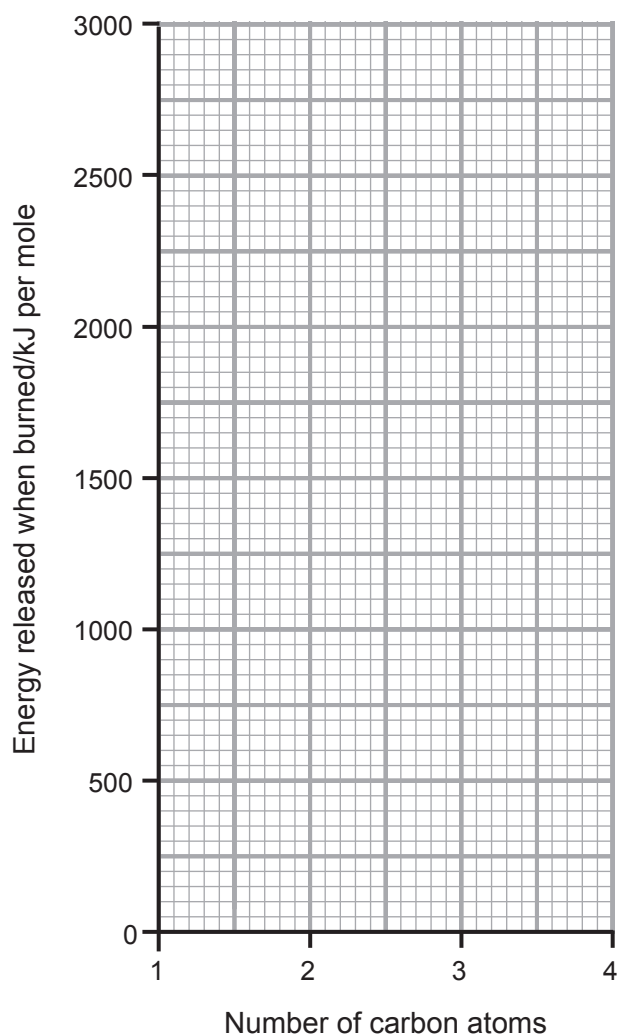
_____ [1]

(b) The table below gives the energy released when the four hydrocarbons burn.

Hydrocarbon	Number of carbon atoms	Energy released when burned/ kJ per mole
methane	1	900
ethane	2	1550
propane	3	2200
butane	4	2850



(i) On the grid below plot and draw a **line graph** to show this information.



[3]

(ii) Pentane is a hydrocarbon with **five** carbon atoms. Predict the energy released when pentane is burned.

_____ kJ per mole [1]

(c) Complete the word equation for the combustion of methane.

methane + oxygen →

+

[2]

[Turn over]





[6]

THIS IS THE END OF THE QUESTION PAPER



BLANK PAGE
DO NOT WRITE ON THIS PAGE

14361



20GSA2118



BLANK PAGE

DO NOT WRITE ON THIS PAGE

14361



20GSA2119

Sources:

Q1(b) . . . Principal Examiner × 3
 Q3 . . . © Getty Images
 Q4(a)(iii) . Principal Examiner
 Q6 . . . Principal Examiner
 Q5(b) . . . Principal Examiner
 Q7(b) . . . Principal Examiner
 Q8(b) . . . © AdobeStock
 Q10. . . Principal Examiner

DO NOT WRITE ON THIS PAGE

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

Examiner Number

Permission to reproduce all copyright material has been applied for.
 In some cases, efforts to contact copyright holders may have been unsuccessful and CCEA
 will be happy to rectify any omissions of acknowledgement in future if notified.



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

1		2																																		0
7 Li Lithium 3		9 Be Beryllium 4																																		4 He Helium 2
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	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																									

1

H

Hydrogen

1

* 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