Cambridge IGCSE[™](9–1)

CHEMISTRY 0971/11

Paper 1 Multiple Choice (Core)

May/June 2022

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet

Soft clean eraser

Soft pencil (type B or HB is recommended)

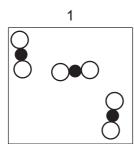
INSTRUCTIONS

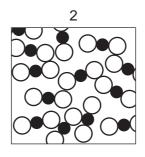
- There are forty questions on this paper. Answer all questions.
- For each question there are four possible answers **A**, **B**, **C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do not use correction fluid.
- Do not write on any bar codes.
- You may use a calculator.

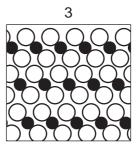
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

1 Diagrams of the three states of matter for carbon dioxide are shown.







PMT

Which two diagrams show the states of matter before and after the sublimation of carbon dioxide?

- **A** 2 to 1
- **B** 2 to 3
- **C** 3 to 1
- **D** 3 to 2
- **2** A student measures the time taken for 2.0 g of magnesium to dissolve in 50 cm³ of dilute sulfuric acid.

Which apparatus is essential to complete the experiment?

- 1 stop-clock
- 2 measuring cylinder
- 3 thermometer
- 4 balance
- **A** 1, 2 and 4
- **B** 1 and 2 only
- C 1 and 4 only
- **D** 2, 3 and 4
- **3** Which method is used to separate a mixture of the following liquids?

liquid	boiling point/°C
methanol	64.5
ethanol	78.5
propan-1-ol	97.2
butan-1-ol	117.0

- A crystallisation
- **B** evaporation
- **C** filtration
- **D** fractional distillation

- 4 Which substance should be pure for the intended use?
 - A a drug for curing disease
 - **B** limestone for iron extraction
 - C petroleum for fractional distillation
 - **D** water for washing a car
- 5 Which row identifies an alloy, a pure metal and a non-metal?

	alloy	pure metal	non-metal
Α	brass	carbon	copper
В	brass	copper	carbon
С	copper	brass	carbon
D	copper	carbon	brass

6 Information about the structures of three atoms, X, Y and Z, is shown.

atom	proton number	nucleon number
Х	1	1
Υ	1	2
Z	1	3

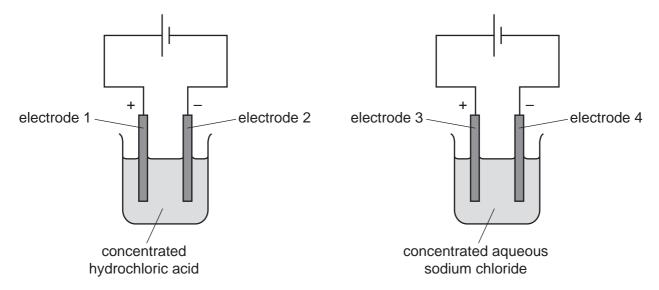
Which statements about atoms X, Y and Z are correct?

- 1 They are isotopes of the same element.
- 2 They contain the same number of electrons.
- 3 They contain the same number of neutrons.
- 4 They contain one occupied electron shell.
- **A** 1, 2 and 4 **B** 1 and 2 only **C** 3 and 4 **D** 3 only
- 7 What happens to an atom when it becomes an ion with a charge of +1?
 - **A** It gains an electron.
 - **B** It gains a proton.
 - C It loses an electron.
 - **D** It loses a proton.

8 The relative atomic mass, A_r , of an element is determined by comparing the mass of one atom of the element with the mass of one atom of element Q.

What is Q?

- A carbon
- **B** chlorine
- C hydrogen
- **D** oxygen
- **9** Which equation for the decomposition of calcium nitrate is correct?
 - **A** $Ca(NO_3)_2 \rightarrow CaO + NO_2 + O_2$
 - $\textbf{B} \quad \text{Ca(NO}_3)_2 \, \rightarrow \, \text{CaO} \, + \, 2\text{NO}_2 \, + \, \text{O}_2$
 - C $2Ca(NO_3)_2 \rightarrow 2CaO + 2NO_2 + O_2$
 - **D** $2Ca(NO_3)_2 \rightarrow 2CaO + 4NO_2 + O_2$
- **10** The diagram shows the electrolysis of concentrated hydrochloric acid and concentrated aqueous sodium chloride using carbon electrodes.



At which electrodes is hydrogen produced?

- A electrode 1 only
- B electrodes 1 and 3
- C electrode 2 only
- D electrodes 2 and 4

11 Overhead power cables made from (steel-cored) aluminium are used to carry electricity over long distances.

Which property of (steel-cored) aluminium makes it suitable for use in power cables?

- A Aluminium has a low density.
- **B** Aluminium has low strength.
- **C** Steel is a good conductor of heat.
- **D** Steel is resistant to corrosion.
- **12** Which row identifies a chemical change and a physical change?

	chemical change	physical change
Α	boiling ethanol	burning ethanol
В	burning ethanol	evaporating ethanol
С	dissolving ethanol in water burning ethanol	
D	evaporating ethanol	dissolving ethanol in water

13 The equation for the reaction when hydrogen is used as a fuel is shown.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Which statement about this reaction is correct?

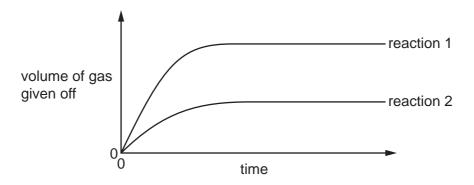
- A Energy is given out so the temperature of the surroundings decreases.
- **B** Energy is taken in so the temperature of the surroundings increases.
- **C** The reaction is endothermic so the temperature of the surroundings decreases.
- **D** The reaction is exothermic so the temperature of the surroundings increases.
- 14 Which fuels release carbon dioxide when burned?
 - 1 gasoline
 - 2 hydrogen
 - 3 methane
 - **A** 1 and 2 **B** 1 and 3 **C** 2 and 3 **D** 3 only

15 Water is added to anhydrous copper(II) sulfate.

What happens during the reaction?

- ${\bf A}$ The copper(II) sulfate turns blue and the solution formed gets colder.
- **B** The copper(II) sulfate turns blue and the solution formed gets hotter.
- **C** The copper(II) sulfate turns white and the solution formed gets colder.
- **D** The copper(II) sulfate turns white and the solution formed gets hotter.
- **16** Excess magnesium ribbon is reacted with a fixed volume of hydrochloric acid and the volume of gas given off over time is measured.

The results of two different experiments are shown.



Which statement explains the differences between the results of the two experiments?

- A Reaction 1 uses a catalyst.
- **B** The acid used is twice as concentrated in reaction 1.
- **C** The magnesium ribbon is in smaller pieces in reaction 2.
- **D** The temperature is higher in reaction 2.
- 17 Which products are formed when magnesium hydroxide reacts with hydrochloric acid?
 - A magnesium chloride, carbon dioxide and water
 - **B** magnesium chloride, hydrogen and water
 - C magnesium chloride and hydrogen only
 - **D** magnesium chloride and water only

18 The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

oxide tested	pH of solution
X	1
Y	13

Which information about X and Y is correct?

	oxide is acidic	oxide is basic	metal	non-metal
Α	Х	Υ	Х	Υ
В	X	Υ	Y	Х
С	Υ	X	X	Y
D	Υ	Х	Υ	Х

19 An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

- **A** crystallisation \rightarrow evaporation \rightarrow filtration
- **B** evaporation \rightarrow crystallisation \rightarrow filtration
- **C** filtration \rightarrow crystallisation \rightarrow evaporation
- **D** filtration \rightarrow evaporation \rightarrow crystallisation

20 Three separate samples of an aqueous compound T are tested.

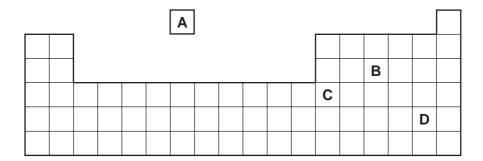
The results of the tests are shown.

test	observation	
acidify with dilute nitric acid, then add aqueous barium nitrate	white precipitate	
add aqueous ammonia	white precipitate, soluble in excess	
add aqueous sodium hydroxide	white precipitate, soluble in excess	

What is T?

- A aluminium chloride
- B aluminium sulfate
- C zinc chloride
- **D** zinc sulfate
- 21 Part of the Periodic Table is shown.

Which element is a metal?



22 The elements sodium to argon form Period 3 of the Periodic Table.

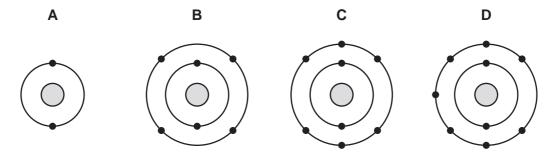
Which row describes the trend across Period 3 from left to right?

	number of outer-shell electrons	metallic character	group number
Α	decreases	decreases	decreases
В	decreases	increases	decreases
С	increases	decreases	increases
D	increases	increases	increases

23 Lithium, sodium and potassium are elements in Group I of the Periodic Table.

Which statement about these elements is correct?

- A Lithium has the highest melting point and the lowest density.
- **B** Lithium has the highest density and the most violent reaction with water.
- **C** Potassium has the highest melting point and the highest density.
- **D** Potassium has the lowest melting point and the least violent reaction with water.
- 24 Which statement describes a transition element?
 - A It can act as a catalyst and some of its compounds can also act as catalysts.
 - **B** It forms white compounds with sulfur, oxygen, chlorine and bromine.
 - C It has a low density and a piece of it will float on water.
 - **D** It is a very poor conductor of electricity.
- 25 Which diagram represents the arrangement of the outer-shell electrons of a noble gas?



- 26 Which statements about the general properties of metals are correct?
 - 1 They are good conductors of heat and electricity.
 - 2 They have low melting points.
 - 3 They react with dilute acids to form a salt and water.
 - 4 They react with oxygen to form basic oxides.
 - **A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4

27 Reactions of three metals and their oxides are shown.

metal	add dilute hydrochloric acid to metal	heat metal oxide with carbon	
1	✓	✓	key
2	✓	X	✓ = reacts
3	X	✓	x = does not react

What is the order of reactivity of these metals, from most reactive to least reactive?

- $\mathbf{A} \quad 1 \to 2 \to 3$
- **B** $1 \rightarrow 3 \rightarrow 2$ **C** $2 \rightarrow 1 \rightarrow 3$ **D** $2 \rightarrow 3 \rightarrow 1$

28 Which uses of the metals shown are correct?

	aluminium	stainless steel
Α	aircraft bodies	car bodies
В	car bodies	aircraft bodies
С	chemical plant	food containers
D	food containers	cutlery

- 29 Which statement about the reactions in the blast furnace is correct?
 - A Carbon reacts with oxygen and heats the furnace.
 - **B** Carbon monoxide removes the silicon dioxide impurity forming slag.
 - Iron(III) oxide is oxidised to iron. C
 - **D** Limestone reduces iron(III) oxide to iron.
- **30** Iron rusts when exposed to air.

Which two substances in air cause iron to rust?

- A carbon dioxide and oxygen
- **B** nitrogen and oxygen
- C oxygen and water
- **D** carbon dioxide and water

31	31 Fertilisers are used to provide three of the elements needed for plant growth				plant growth.			
	Which two compounds would give a fertiliser containing all three of these elements					of these elements?		
	Α	Ca(NO ₃) ₂ and (NH ₄) ₂ SO ₄				
	В	Ca(NO ₃) ₂ and (NH ₄) ₃ PO ₄				
	С	KNO₃ aı	nd $(NH_4)_2S($	O_4				
	D	KNO ₃ aı	nd (NH ₄) ₃ P(O ₄				
32	Wh	ich proce	ess produce	s methane?				
	Α	combus	tion of hydr	ocarbons				
	В	decomp	osition of v	egetation				
	С	respirati	on					
	D	reaction	between h	ydrochloric acid	d and	calcium carbo	onate	
33	Wh	ich stater	ments abou	t sulfur dioxide	are c	orrect?		
		1	Sulfur diox	ride decolourise	es aci	dified potassiu	ım mar	nganate(VII).
		2	Sulfur diox	ride forms wher	n acid	s react with ca	arbona	tes.
		3	Sulfur diox	ide is used as a	a blea	ach.		
		4	Sulfur diox	ride is used to t	reat a	ıcidic soil.		
	Α	1 and 3	В	1 and 4	С	2 and 3	D	2 and 4
34	Wh	at are the	e products v	when limestone	(calc	ium carbonate	e) is he	ated strongly?
	Α		•	and carbon dio	`		,	3,7
	В		•	and carbon mo		е		
	С		•	carbon dioxide				
	D	calcium	oxide and	carbon monoxid	de			
35	In v	vhich lists	s are the co	mpounds in the	e sam	e homologous	s series	s?
		1				9		
		2	CH ₄ , C ₂ H ₄	, С ₃ П ₈ ₂ Н ₅ ОН, С ₃ Н ₇ ОІ	┙			
		3		2H3CH2OH, C		I°CH°OH		
							_	0
	Α	1 and 2	В	1 and 3	С	2 only	D	3 only

36 Which row about aqueous ethanoic acid and dilute hydrochloric acid is correct?

	both contain carbon	both contain hydrogen	both react with carbonates	
Α	✓	x	✓	key
В	✓	✓	x	✓= yes
С	x	✓	✓	x = no
D	X	x	x	

- 37 Some properties of colourless liquid L are listed.
 - It boils at 65 °C.
 - When added to water, two layers form which do not mix.
 - It does not react with sodium carbonate.
 - It has no effect on bromine water.

What is L?

- **A** ethanol
- **B** hexane
- C hexene
- **D** ethanoic acid
- **38** A molecule of compound P contains two carbon atoms and four hydrogen atoms.

Which row represents P?

	name of compound	<i>M</i> _r	reacts with aqueous bromine
Α	ethane	30	X
В	ethene	16	✓
С	ethene	28	✓
D	ethene	28	X

39 The equation representing the reaction of a hydrocarbon with water is shown.

$$C_xH_v + H_2O \xrightarrow{\text{catalyst}} C_xH_5OH$$

What are the values of x and y?

	X	у
Α	1	4
В	1	6
С	2	4
D	2	6

40 Many molecules of J join together in reaction R to form a long chain molecule K.

K is the only product.

Which row describes molecule J, reaction R and molecule K?

	molecule J	reaction R	molecule K
A	polymer	addition	monomer
В	monomer	addition	polymer
С	polymer	cracking	monomer
D	monomer	cracking	polymer

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The Periodic Table of Elements

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	=	5	Ė	helii 4	10	Ž	nec 20	1	⋖	argon 40	36		kryp 8	25	×	xen 13	86	<u>~</u>	rade			
	=				6	ட	fluorine 19	17	CI	chlorine 35.5	35	Ŗ	bromine 80	53	_	iodine 127	85	¥	astatine			
	>				80	0	oxygen 16	16	S	sulfur 32	34	Se	selenium 79	52	<u>a</u>	tellurium 128	84	Ъ	moloulum —	116	_	livermorium
	>				7	Z	nitrogen 14	15	۵	phosphorus 31	33	As	arsenic 75	51	Sp	antimony 122	83	<u>B</u>	bismuth 209			
	≥				9	O	carbon 12	14	S	silicon 28	32	Ge	germanium 73	20	Sn	tin 119	82	Pb	lead 207	114	Εl	flerovium
	≡				2	Δ	boron 11	13	Αl	aluminium 27	31	Ga	gallium 70	49	므	indium 115	81	<i>1</i> L	thallium 204			
								•			30	Zu	zinc 65	48	ပ	cadmium 112	80	Нg	mercury 201	112	ပ်	copernicium
											29	n O	copper 64	47	Ag	silver 108	62	Αn	gold 197	111	Rg	roentgenium
Group											28	z	nickel 59	46	Pd	palladium 106	78	₹	platinum 195	110	Ds	darmstadtium -
Gro											27	ပိ	cobalt 59	45	Rh	rhodium 103	77	_	iridium 192	109	Μ̈́	meitnerium -
		-]	С,	hydrogen 1							26	Fe	iron 56	44	Ru	ruthenium 101	92	SO	osmium 190	108	Hs	hassium
					•						25	Mn	manganese 55	43	ည	technetium -	75	Re	rhenium 186	107	Bh	bohrium
						loc	ass				24	ပ်	chromium 52	42	Mo	molybdenum 96	74	>	tungsten 184	106	Sg	seaborgium
				Key	atomic number	atomic symbo	name relative atomic mass				23	>	vanadium 51	41	g	niobium 93	73	<u>n</u>	tantalum 181	105	6	dubnium
						ato	rela				22	F	titanium 48	40	Zr	zirconium 91	72	士	hafnium 178	104	₹	rutherfordium -
											21	Sc	scandium 45	39	>	yttrium 89	57–71	lanthanoids		89–103	actinoids	
	=				4	Be	beryllium 9	12	Mg	magnesium 24	20	Ca	calcium 40	38	ഗ്	strontium 88	56	Ba	barium 137	88	Ra	radium
	_				3	:=	lithium 7	11	Na	sodium 23	19	¥	potassium 39	37	Rb	rubidium 85	55	S	caesium 133	87	Ē	francium

	22	58	69	09	61	62	63	64	65	99	29	89	69	20	71	
anthanoids	Гa	Ce	Ā	PN	Pm	Sm	Вu	P G	Р	ò	웃	Щ	H	Υp	P	
	lanthanum 139	cerium 140	praseodymium 141	neodymium 144	promethium -	samarium 150	europium 152	gadolinium 157	terbium 159	dysprosium 163	holmium 165	erbium 167	thulium 169	ytterbium 173	lutetium 175	
	88	06	91	92	93	94	92	96	26	86	66	100	101	102	103	
	Ac	H	Ра	\supset	d	Pu	Am	CB	益	ర	Es	Fm	Md	%	۲	
	actinium	thorium	protactinium	uranium	neptunium	plutonium	americium	curium	berkelium	californium	einsteinium	fermium	mendelevium	nobelium	lawrencium	
	I	232	231	238	ı	ı	I	ı	I	ı	I	I	ı	ı	ı	

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).