



Cambridge International Examinations

Cambridge International General Certificate of Secondary Education

CHEMISTRY (US) 0439/13

Paper 1 Multiple Choice (Core) May/June 2016

45 Minutes

Additional Materials: Multiple Choice Answer Sheet

Soft clean eraser

Soft pencil (type B or HB is recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Center number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.



1 In which changes do the particles move further apart?

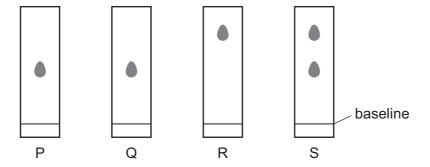
$$\begin{array}{ccc} & W & X \\ \text{gas} & \rightleftharpoons & \text{liquid} & \rightleftharpoons & \text{solid} \\ & Y & & Z \end{array}$$

- **A** W and X
- **B** W and Z
- C X and Y
- **D** Y and Z

2 Chromatography experiments are carried out on four substances, P, Q, R and S.

The same solvent is used in each experiment.

The resulting chromatograms are shown below.



Which statement is **not** correct?

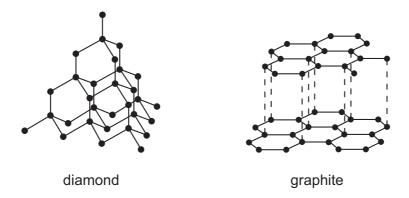
- A P and Q are pure substances.
- **B** P and R are different substances.
- **C** R and S are pure substances.
- **D** S is a mixture of substances.
- 3 One of the instructions for an experiment reads as follows.

Quickly add 50 cm³ of acid.

What is the best piece of apparatus to use?

- A a buret
- **B** an Erlenmeyer flask
- C a graduated cylinder
- **D** a pipet

4 The structures of diamond and graphite are shown.



Which statement about diamond and graphite is **not** correct?

- A Diamond is used in cutting tools because the strong covalent bonds make it very hard.
- **B** Graphite acts a lubricant because of the weak bonds between the layers.
- **C** Graphite conducts electricity because the electrons between the layers are free to move.
- **D** Graphite has a low melting point because of the weak bonds between the layers.
- 5 The table shows the electronic structure of four atoms.

atom	electronic structure
W	2,8,1
X	2,8,4
Υ	2,8,7
Z	2,8,8

Which two atoms combine to form a covalent compound?

A W and X

B W and Y

C X and Y

D X and Z

6 The table shows the atomic structure of four atoms.

Which atom is **not** a metal?

	electrons	neutrons	protons
Α	18	22	18
В	19	20	19
С	19	21	19
D	20	20	20

7 Potassium, K, forms a compound with fluorine, F.

Which statements about this compound are correct?

- 1 The compound is ionic.
- 2 The formula of the compound is KF.
- 3 The compound is soluble in water.
- **A** 1, 2 and 3
- **B** 1 and 2 only
- C 1 and 3 only
- **D** 2 and 3 only

8 The equation shows the reaction between magnesium and sulfuric acid.

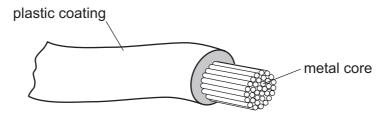
[A_r: H, 1; O, 16; Mg, 24; S, 32]

$$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2$$

In this reaction, which mass of magnesium sulfate is formed when 6g of magnesium react with excess sulfuric acid?

- **A** 8
- **B** 24
- **C** 30
- **D** 60

9 The diagram shows an electrical cable.



Which statement about the substances used is correct?

- A The coating is plastic because it conducts electricity well.
- **B** The core is copper because it conducts electricity well.
- **C** The core is copper because it is cheap and strong.
- **D** The core is iron because it is cheap and strong.

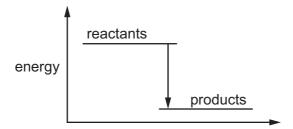
10 Electricity is passed separately through concentrated hydrochloric acid, concentrated aqueous sodium chloride and dilute sulfuric acid.

In which rows are the electrolysis products correctly named?

		cathode product	anode product
1	concentrated hydrochloric acid	hydrogen	chlorine
2	concentrated aqueous sodium chloride	sodium	chlorine
3	dilute sulfuric acid	hydrogen	oxygen

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

11 The energy level diagram shows the energy of the reactants and products in a chemical reaction.

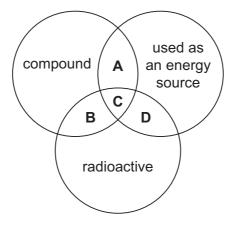


Which row correctly describes the energy change and the type of reaction shown?

	energy change	type of reaction
A	energy is given out to the surroundings	endothermic
В	energy is given out to the surroundings	exothermic
С	energy is taken in from the surroundings	endothermic
D	energy is taken in from exothermic the surroundings	

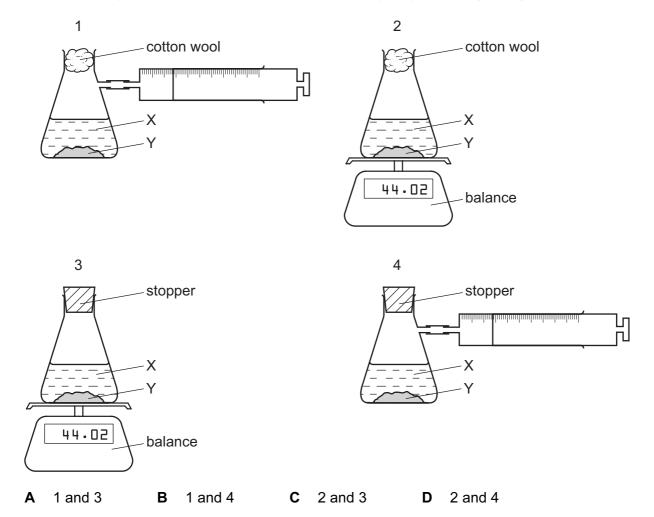
12 The diagram shows some properties that substances may have.

To which labeled part of the diagram does ²³⁵U belong?



13 A liquid X reacts with solid Y to form a gas.

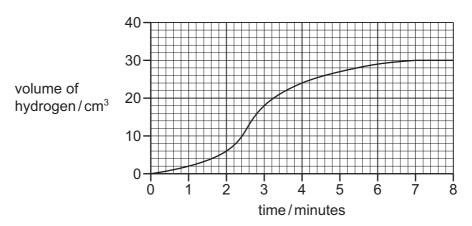
Which two diagrams show suitable methods for investigating the rate (speed) of the reaction?



14 Magnesium is reacted with a dilute acid.

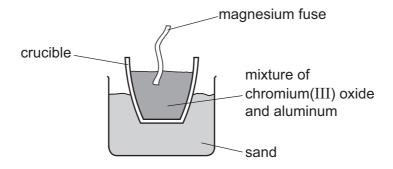
The hydrogen gas is collected and its volume measured.

The results are shown on the graph.



Between which times was the reaction fastest?

- A 0 and 1 minute
- B 1 and 2 minutes
- C 2 and 3 minutes
- **D** 7 and 8 minutes
- **15** A violent reaction occurs when a mixture of chromium(III) oxide and aluminum is ignited with a magnesium fuse as shown.



The equation for the reaction is shown.

$$Cr_2O_3 + 2Al \rightarrow 2Cr + Al_2O_3$$

Which substance is oxidized in the reaction?

- **A** aluminum
- B aluminum oxide
- C chromium
- **D** chromium(III) oxide

16 Equations for the effect of water on anhydrous cobalt(II) chloride and anhydrous copper(II) sulfate are shown.

$$CoCl_2(s) + 6H_2O(I) \rightarrow CoCl_2.6H_2O(s)$$

 $CuSO_4(s) + 5H_2O(I) \rightarrow CuSO_4.5H_2O(s)$

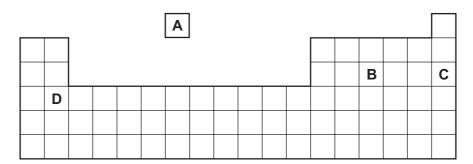
Which statement is **not** correct?

- **A** Both reactions can be reversed by changing the conditions.
- **B** Both reactions can be used as a test for water.
- **C** The color change observed when hydrated copper(II) sulfate is heated is from blue to white.
- **D** The color change observed when water is added to anhydrous cobalt(II) chloride is from pink to blue.
- **17** Which statements are properties of an acid?
 - 1 reacts with ammonium sulfate to form ammonia
 - 2 turns red litmus blue

	1	2
Α	✓	✓
В	✓	X
С	X	✓
D	X	X

18 Part of the Periodic Table is shown.

Which element forms an acidic oxide?



19 Salts can be made by adding different substances to dilute hydrochloric acid.

For which substance could any excess **not** be removed by filtration?

- A copper(II) oxide
- **B** magnesium
- C sodium hydroxide
- D zinc hydroxide
- **20** A solution containing substance X was tested. The table shows the results.

test	result
flame test	lilac color
acidified silver nitrate solution added	yellow precipitate

What is X?

- A lithium bromide
- **B** lithium iodide
- C potassium bromide
- D potassium iodide
- 21 Where in the Periodic Table is the metallic character of the elements greatest?

	left or right side of a period	at the top or bottom of a group
Α	left	bottom
В	left	top
С	right	bottom
D	right	top

- 22 Which statement about the elements in Group I is correct?
 - **A** Hydrogen is evolved when they react with water.
 - **B** lons of Group I elements have a −1 charge.
 - **C** Sodium is more reactive than potassium.
 - **D** Solid sodium is a poor electrical conductor.

23 Osmium is a transition element.

Which row gives the expected properties of osmium?

	melting point	density	compounds formed
Α	high	high	colored
В	high	high	white
С	high	low	white
D	low	high	colored

- 24 Two statements about noble gases are given.
 - 1 Noble gases are reactive, monatomic gases.
 - 2 Noble gases all have full outer shells of electrons.

Which is correct?

- **A** Both statements are correct and statement 2 explains statement 1.
- **B** Both statements are correct but statement 2 does not explain statement 1.
- C Statement 1 is correct but statement 2 is incorrect.
- **D** Statement 2 is correct but statement 1 is incorrect.
- 25 Some properties of substance X are listed.
 - It conducts electricity when molten.
 - It has a high melting point.
 - It burns in oxygen and the product dissolves in water to give a solution with pH 11.

What is X?

- A a covalent compound
- B a macromolecule
- **C** a metal
- **D** an ionic compound

	26	The list	shows the	order of	reactivity	of some	elements
--	----	----------	-----------	----------	------------	---------	----------

K Na Ca Mg Zn Fe (H) Cu

Which statement about the reactivity of these metals is correct?

- A Copper reacts with steam to form hydrogen gas.
- **B** Magnesium is more reactive than calcium.
- **C** Potassium reacts with water to form hydrogen gas.
- **D** Sodium oxide is reduced by carbon to sodium.

27 Iron is obtained from its ore in a blast furnace and is used to make steel.

Iron obtained from the blast furnace is contaminated with1.....

In order to remove this substance,2..... is passed through the molten iron.

.....3..... is also added to remove oxides of phosphorus and silicon which are4......

Which words complete the sentences about the conversion of iron to steel?

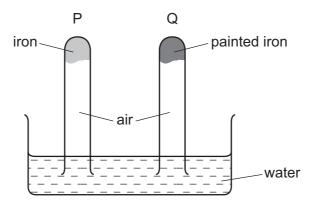
	1	2	3	4
Α	carbon	nitrogen	calcium carbonate	acidic
В	carbon	oxygen	calcium oxide	acidic
С	carbon	oxygen	calcium oxide	basic
D	sand	oxygen	calcium oxide	basic

28 Copper is a transition element used to make saucepans.

Which property is **not** correct for copper?

- A good conductor of heat
- B insoluble in water
- C low melting point
- **D** malleable (can be hammered into shape)

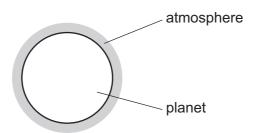
29 The diagram shows an experiment to investigate how paint affects the rusting of iron.



What happens to the water level in tubes P and Q?

	tube P	tube Q
Α	falls	rises
В	no change	rises
С	rises	falls
D	rises	no change

30 A new planet has been discovered and its atmosphere has been analyzed.



The table shows the composition of its atmosphere.

gas	percentage by volume
carbon dioxide	4
nitrogen	72
oxygen	24

Which gases are present in the atmosphere of the planet in a higher percentage than they are in the Earth's atmosphere?

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

31	The following substar	nces can be forn	nad whan aasolin	a is hurnt in	a car engine
J I	THE IDIIOWING SUBSIAL	ices can be ioni	neu when gasoiin	e is buille ill	a car engine.

Which substance is the main cause of acid rain?

- A carbon
- B carbon monoxide
- C nitrogen dioxide
- **D** water

32 Which statement about methane is **not** correct?

- A It is a greenhouse gas.
- **B** It is an alkene.
- **C** It is formed by decomposition of vegetation.
- **D** It is used as a fuel.

33 The formulae of four compounds, W, X Y and Z, are given.

compound	formula
W	FeSO ₄
X	(NH ₄) ₃ PO ₄
Y	KNO ₃
Z	NaC1

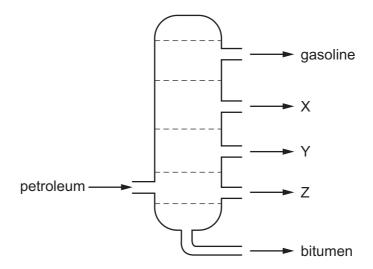
Which mixture of compounds makes a complete fertilizer?

- A W and X
- **B** W and Z
- C X and Y
- **D** Y and Z

34 Which process is used to make lime (calcium oxide) from limestone (calcium carbonate)?

- **A** chromatography
- **B** electrolysis
- **C** fractional distillation
- **D** thermal decomposition

35 The diagram shows the separation of petroleum into fractions.



What could X, Y and Z represent?

	Х	Y	Z
Α	diesel oil	lubricating fraction	paraffin
В	lubricating fraction	diesel oil	paraffin
С	paraffin	lubricating fraction	diesel oil
D	paraffin	diesel oil	lubricating fraction

- **36** Which compound does **not** belong to the same homologous series as the other three compounds?
 - A CH₃OH
- **B** C₂H₅COOH
- \mathbf{C} C_2H_5OH
- \mathbf{D} $C_7H_{15}OH$
- 37 Which reaction is used as a test for alkenes?
 - A Alkenes burn in air to give carbon dioxide and water.
 - **B** Alkenes decolorize aqueous bromine.
 - **C** Alkenes form polymers when heated in the presence of a catalyst.
 - **D** Alkenes react with steam to form alcohols.
- **38** Which statement about ethanol is correct?
 - A It burns in air to form ethene and water.
 - **B** It is prepared from ethene by fermentation.
 - **C** It is prepared from glucose in an addition reaction.
 - **D** It is the only product when ethene reacts with steam.

39 Ethene forms an addition polymer as shown.

Which terms describe this polymer?

- **A** a saturated compound called poly(ethane)
- **B** a saturated compound called poly(ethene)
- **C** an unsaturated compound called poly(ethane)
- **D** an unsaturated compound called poly(ethene)
- **40** Liquid W burns completely to give carbon dioxide and water.

Liquid W is a compound containing carbon, hydrogen and oxygen.

A solution of liquid W in water is pH7.

What is liquid W?

- A ethanoic acid
- **B** ethanol
- C gasoline
- **D** methane

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

The Periodic Table of Elements

≡	₂ <u>a</u>	j ii 4	0	<u>e</u>	0;	8	>	nog O:	92	٦	pton 14	4.	(e)	non 31	98	Ľ	don –			
>	_ I	• hei		_	~ ~		4	an 4	(n)	<u>*</u>	Kry.	5	×	×	80	Ľ.	ğ '			
₹			6	ш	fluorine 19	17	Cl	chlorine 35.5	35	B	bromine 80	53	Н	iodine 127	85	Αt	astatine -			
5			80	0	oxygen 16	16	ഗ	sulfur 32	34	Se	selenium 79	52	<u>e</u>	tellurium 128	84	Ъо	molod	116	_	livermorium
>			7	z	nitrogen 14	15	۵	phosphorus 31	33	As	arsenic 75	51	Sp	antimony 122	83	Ξ	bismuth 209			
2	•		9	ပ	carbon 12	14	S	silicon 28	32	Ge	germanium 73	50	Su	tin 119	82	В	lead 207	114	Εl	flerovium
=			2	Ω	boron 11	13	Αl	aluminum 27	31	Ga	gallium 70	49	In	indium 115	81	11	thallium 204			
						I			30	Zu	zinc 65	48	ပ္ပ	cadmium 112	80	Hg	mercury 201	112	S	copernicium
									29	Cn	copper 64	47	Ag	silver 108	62	Au	gold 197	111	Rg	roentgenium -
									28	Z	nickel 59	46	Pd	palladium 106	78	Ŧ	platinum 195	110	Ds	darmstadtium -
									27	ပိ	cobalt 59	45	몬	rhodium 103	77	٦	iridium 192	109	Μţ	meitnerium -
	- I	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	SS				24	ပ်	chromium 52	42	Mo	molybdenum 96	74	>	tungsten 184	106	Sg	seaborgium
		Key	tomic number	mic symt	name Itive atomic ma				23	>	vanadium 51	41	g	niobium 93	73	<u>ra</u>	tantalum 181	105	Q O	dubnium
			ď	ato	rela				22	j	titanium 48	40	Zr	zirconium 91	72	士	hafnium 178	104	弘	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	Š	strontium 88	56	Ва	barium 137	88	Ra	radium
_			8	:=	lithium 7	=	Na	sodium 23	19	¥	potassium 39	37	&	rubidium 85	55	Cs	cesium 133	87	<u>г</u>	francium
	N		1	II	II	II	II	II	III	II	III	II	II	II	III IV V VI VII VI	II	III	H	III IV V VI VIII VIIII VIII VIII	1 1 1 1 1 1 1 1 1 1

$\overline{}$			_		
71]	lutetium 175	103	۲	lawrencium -
70	χp	ytterbium 173	102	8	nobelium –
69	E	thulium 169	101	Md	mendelevium -
89	ш	erbium 167	100	Fm	fermium -
29	운	holmium 165	66	Es	einsteinium
99	ò	dysprosium 163	86	ర్	californium -
65	욘	terbium 159	97	B	berkelium
64	Вg	gadolinium 157	96	Cm	curium
63	Ш	europium 152	92	Am	americium -
62	Sm	samarium 150	94	Pu	plutonium
61	Pm	promethium —	93	ď	neptunium -
09	PZ	neodymium 144	92	\supset	uranium 238
59	Ŗ	praseodymium 141	91	Ра	protactinium 231
58	Ce	cerium 140	06	Ч	thorium 232
22	Гa	lanthanum 139	88	Ac	actinium -

lanthanoids

actinoids

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