Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/23**

Paper 2 Multiple Choice (Extended) **May/June 2018**

45 minutes

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

* 8 8 7 6 2 4 2 7 0 8 4 *

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre 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.

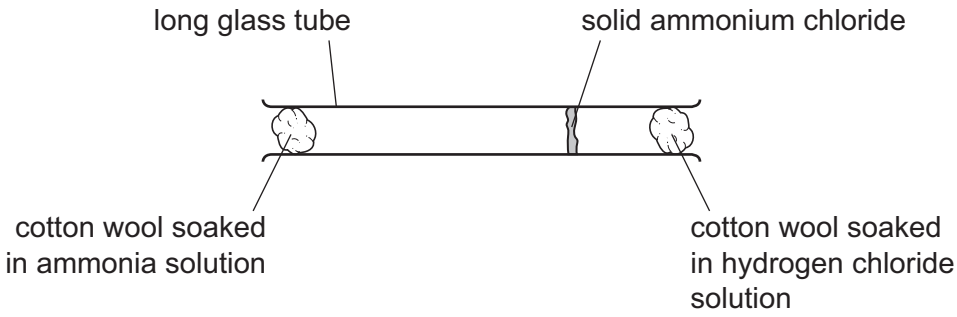
The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **14** printed pages and **2** blank pages.

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1 Ammonia gas is reacted with hydrogen chloride gas using the apparatus shown.

Solid ammonium chloride is produced.



Which statement explains why the solid ammonium chloride is formed nearer to the hydrogen chloride?

A Ammonia solution is a base and hydrogen chloride solution is an acid.

B Ammonia molecules diffuse more slowly than hydrogen chloride molecules.

C Hydrogen chloride has a greater molecular mass than ammonia.

D Hydrogen chloride moves by Brownian motion.

2 Paper chromatography is done in the same way with three different mixtures of dyes. Each mixture contains at least one of the dyes W, X, Y and Z.

The R_f values of the dyes in the three mixtures are shown.

dye	R_f values from mixture 1	R_f values from mixture 2	R_f values from mixture 3
W	0.15	0.15	0.15
X	0.00	0.00	0.00
Y	0.50	0.50	0.50
Z	0.00	0.91	0.91

Which conclusion is correct?

A Dye W is nearest the solvent front and is present only in mixture 1 and mixture 3.

B Dye X has travelled furthest up the chromatography paper.

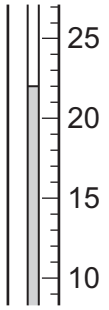
C Dye Y is the only dye present in all three mixtures.

D Dye Z is nearest the solvent front and is found in only two of the mixtures.

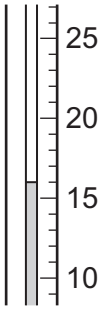
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3 Solid R reacted with dilute sulfuric acid.

The initial temperature of the dilute sulfuric acid and the final temperature of the solution are shown.



initial temperature of the dilute sulfuric acid (°C)

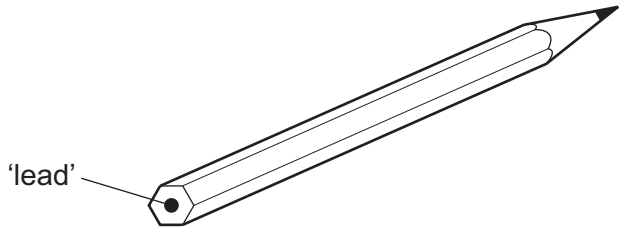


final temperature of the solution (°C)

What was the change in temperature in °C?

A –6 **B** –4 **C** 4 **D** 6

4 The 'lead' in a pencil is made of a mixture of graphite and clay.



When the percentage of graphite is increased, the pencil slides across the paper more easily.

Which statement explains this observation?

A Graphite has a high melting point.

B Graphite is a form of carbon.

C Graphite is a lubricant.

D Graphite is a non-metal.

5 Iron has an atomic number of 26. It occurs as the isotopes ^{54}Fe, ^{56}Fe, ^{57}Fe and ^{58}Fe.

Which statement explains why these isotopes have the same chemical properties?

A They have similar mass numbers.

B They have the same number of electrons in their outer shells.

C They have the same number of neutrons in their nuclei.

D They have the same number of protons in their nuclei.

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6 How many silicon atoms are bonded to each oxygen atom in a crystal of silicon(IV) oxide?

A 1 **B** 2 **C** 3 **D** 4

7 Which substance is **not** a macromolecule?

A diamond

B graphite

C silicon(IV) oxide

D sulfur

8 An experiment was done to determine the formula of a hydrocarbon, C_xH_y.

10 cm^3 of the gaseous hydrocarbon, C_xH_y, was burned in an excess of oxygen to form 20 cm^3 of carbon dioxide and 30 cm^3 of water vapour.

What is C_xH_y?

A CH_4 **B** C_2H_4 **C** C_2H_6 **D** C_3H_8

9 4.00 g of solid sodium hydroxide is added to water to make a solution with a concentration of 0.200 mol/dm^3.

What is the volume of water used?

A 0.5 cm^3 **B** 20 cm^3 **C** 500 cm^3 **D** 2000 cm^3

10 Aqueous copper(II) sulfate is electrolysed using copper electrodes.

Which statement is correct?

A Oxygen gas is produced at the positive electrode.

B The blue colour of the solution gradually fades.

C The concentration of copper ions in the solution stays the same.

D The mass of the negative electrode decreases.

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11 Dilute sulfuric acid is electrolysed using inert electrodes.

What are the ionic half-equations for the reactions that take place at each electrode?

	positive electrode	negative electrode
A	$2H^+ + 2e^- \rightarrow H_2$	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$
B	$2H^+ + 2e^- \rightarrow H_2$	$4OH^- + 4H^+ \rightarrow 4H_2O$
C	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$	$2H^+ + 2e^- \rightarrow H_2$
D	$4OH^- + 4H^+ \rightarrow 4H_2O$	$2H^+ + 2e^- \rightarrow H_2$

12 Information about two reactions is given.

- The neutralisation reaction between citric acid and sodium hydrogencarbonate is endothermic.
- The displacement reaction between magnesium and carbon dioxide is exothermic.

Which statements about the two reactions are correct?

1 The energy of the products formed in the neutralisation reaction is greater than the energy of the reactants.

2 The energy of magnesium and carbon dioxide is greater than the energy of magnesium oxide and carbon.

3 In an exothermic reaction, the energy required to break the bonds is greater than the energy released when the new bonds are formed.

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

13 Ethene reacts with hydrogen. The equation is shown.

$$CH_2{=}CH_2 + H_2 \rightarrow C_2H_6$$

The bond energies are shown in the table. The reaction is exothermic.

bond	bond energy in kJ / mol
C–C	+350
C=C	+610
C–H	+410
H–H	+436

What is the energy change for the reaction?

A –560 kJ / mol **B** –124 kJ / mol **C** +486 kJ / mol **D** +5496 kJ / mol

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14 Which row describes the effects of increasing both concentration and temperature on the collisions between reacting particles?

	increasing concentration	increasing temperature
A	more collisions per second only	more collisions per second only
B	more collisions per second and more collisions with sufficient energy to react	more collisions per second only
C	more collisions per second only	more collisions per second and more collisions with sufficient energy to react
D	more collisions per second and more collisions with sufficient energy to react	more collisions per second and more collisions with sufficient energy to react

15 In the Contact process, sulfur dioxide is converted into sulfur trioxide in a reversible reaction.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction is exothermic.

Which conditions give the highest yield of sulfur trioxide at equilibrium?

	pressure / atmospheres	temperature
A	0.5	high
B	0.5	low
C	1.5	high
D	1.5	low

16 The equation for a redox reaction is shown.

$$2Fe^{3+} + Zn \rightarrow 2Fe^{2+} + Zn^{2+}$$

Which statements are correct?

1 Fe^{3+} is reduced to form Fe^{2+}.

2 Zn oxidises the Fe^{3+} ions.

3 Fe^{3+} is an oxidising agent.

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

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17 Which statement about oxides is correct?

A A solution of magnesium oxide has a pH less than pH 7.

B A solution of sulfur dioxide has a pH greater than pH 7.

C Magnesium oxide reacts with nitric acid to make a salt.

D Sulfur dioxide reacts with hydrochloric acid to make a salt.

18 The equation represents an equilibrium in aqueous ammonia.

$$NH_3(aq) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

How does aqueous ammonia behave in this reaction?

A as a strong acid

B as a strong base

C as a weak acid

D as a weak base

19 An excess of aqueous sodium sulfate was added to aqueous barium chloride and the mixture was filtered.

Which row shows the identity of the residue and the substances present in the filtrate?

	residue	substances in filtrate
A	barium sulfate	barium chloride and sodium chloride
B	barium sulfate	sodium chloride and sodium sulfate
C	sodium chloride	barium chloride and sodium sulfate
D	sodium chloride	barium sulfate and sodium sulfate

20 Which methods are suitable for preparing **both** zinc sulfate and copper(II) sulfate?

1 reacting the metal oxide with warm dilute aqueous sulfuric acid

2 reacting the metal with dilute aqueous sulfuric acid

3 reacting the metal carbonate with dilute aqueous sulfuric acid

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

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21 Which element is classified as a non-metal in the Periodic Table?

A calcium

B chlorine

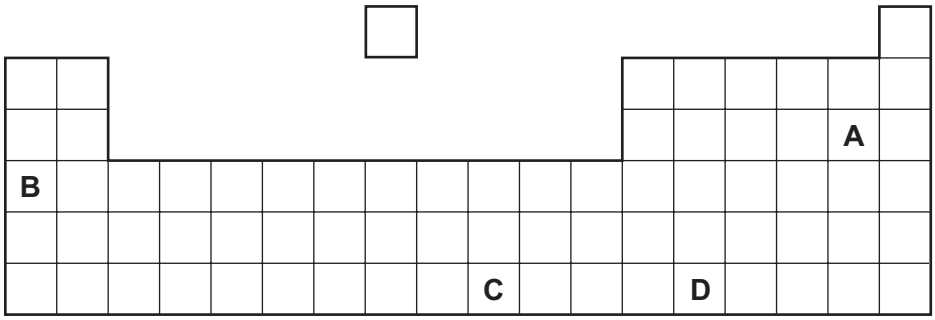
C chromium

D copper

22 Part of the Periodic Table is shown.

Element Q has a low boiling point, low density and does not conduct electricity.

Which element is Q?

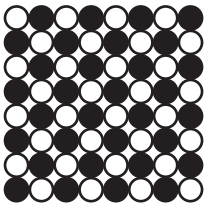


23 Which row describes a typical transition element?

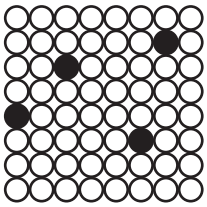
	density in g / cm^3	melting point in °C	boiling point in °C	colour of oxide
A	0.97	98	883	white
B	2.64	769	1382	white
C	3.10	–7	59	yellow
D	8.96	1085	2562	red

24 Which diagram represents a solid alloy?

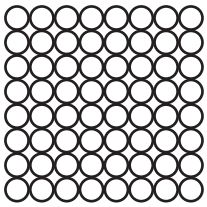
A



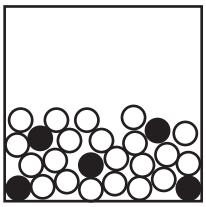
B



C



D



25 The ionic equations for four reactions are shown.

$$Z + X^{2+} \rightarrow Z^{2+} + X$$

$$Z + 2W^{+} \rightarrow Z^{2+} + 2W$$

$$X + 2W^{+} \rightarrow X^{2+} + 2W$$

$$Y + Z^{2+} \rightarrow Y^{2+} + Z$$

What is the order of reactivity of the four metals, W, X, Y and Z?

	most reactive ⟶ least reactive			
A	W	X	Z	Y
B	X	W	Y	Z
C	Y	Z	X	W
D	Z	W	X	Y

26 Which equation represents the first stage in the extraction of zinc from zinc blende?

A $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

B $ZnS + H_2O \rightarrow ZnO + H_2S$

C $ZnO + CO \rightarrow Zn + CO_2$

D $ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$

27 Which statement explains why aluminium is used to manufacture aircraft?

A It has a low density.

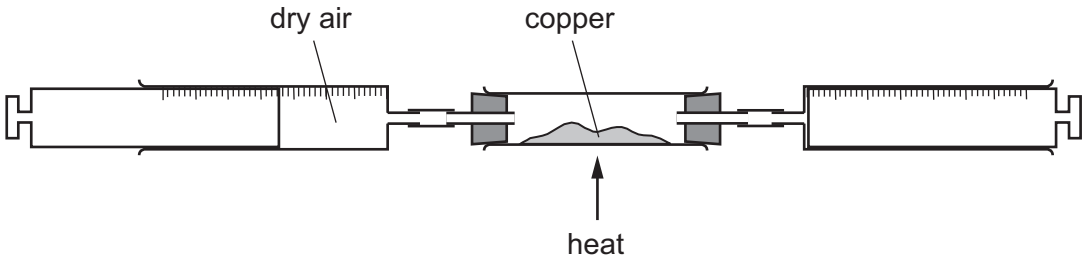
B It is a good conductor of electricity.

C It is a good conductor of heat.

D It is ductile.

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28 Dry air is passed over hot copper until all the oxygen has reacted.



The volume of gas at the end of the reaction is 120 cm^3.

What is the starting volume of dry air?

A 132 cm^3 **B** 152 cm^3 **C** 180 cm^3 **D** 570 cm^3

29 A steel bicycle which had been left outdoors for several months was starting to rust.

What would **not** reduce the rate of corrosion?

A Remove the rust and paint the bicycle.

B Remove the rust and store the bicycle in a dry shed.

C Remove the rust and wipe the bicycle with a clean, damp cloth.

D Remove the rust and wipe the bicycle with an oily cloth.

30 Which statements about water are correct?

1 Household water contains dissolved salts.

2 Water for household use is filtered to remove soluble impurities.

3 Water is treated with chlorine to kill bacteria.

4 Water is used in industry for cooling.

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2, 3 and 4 only

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31 Ammonia is manufactured by reacting hydrogen with nitrogen in the Haber process.

Which row describes the sources of hydrogen and nitrogen and the conditions used in the manufacture of ammonia in the Haber process?

	source of hydrogen	source of nitrogen	temperature of reaction / °C	pressure of reaction / atm
A	air	natural gas	250	2
B	air	natural gas	250	200
C	natural gas	air	450	2
D	natural gas	air	450	200

32 Which statements about the carbon cycle are correct?

1 Carbon dioxide is added to the atmosphere by respiration.

2 Carbon dioxide is added to the atmosphere by combustion of coal.

3 Carbon dioxide is removed from the atmosphere by photosynthesis.

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

33 Element Z forms an oxide, ZO_2. Three uses of ZO_2 are listed.

- bleaching agent
- killing bacteria
- manufacturing an important acid

What is Z?

A carbon

B lead

C nitrogen

D sulfur

34 Limestone is an important material with many uses.

Limestone is heated to produce .....1..... and carbon dioxide.

This reaction is called .....2..... .

Which words correctly complete gaps 1 and 2?

	1	2
A	lime	neutralisation
B	lime	thermal decomposition
C	slaked lime	neutralisation
D	slaked lime	thermal decomposition

35 What is **not** the correct use of the fraction named?

	name of fraction	use
A	fuel oil	making waxes
B	gas oil	fuel in diesel engines
C	kerosene	jet fuel
D	naphtha	making chemicals

36 Methane, ethane and propane belong to a family of hydrocarbons called alkanes.

What is the general formula of an alkane?

A C_nH_{2n} **B** C_nH_{2n+1} **C** C_nH_{2n-1} **D** C_nH_{2n+2}

37 Which substances can be obtained by cracking hydrocarbons?

A ethanol and ethene

B ethanol and hydrogen

C ethene and hydrogen

D ethene and poly(ethene)

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38 Which row describes an advantage and a disadvantage of making ethanol by fermentation?

	advantage	disadvantage
A	uses a renewable resource	occurs at a slow rate
B	needs a high temperature	produces impure ethanol as a product
C	produces pure ethanol as a product	needs a high temperature
D	occurs at a slow rate	uses a non-renewable resource

39 Which esters have the molecular formula $C_5H_{10}O_2$?

1 ethyl propanoate

2 propyl ethanoate

3 butyl methanoate

4 methyl butanoate

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1 and 2 only

D 3 and 4 only

40 A polymer linkage contains carbon, hydrogen, nitrogen and oxygen atoms.

Which row about the polymer is correct?

	type of polymer	formed by
A	polyamide	addition polymerisation
B	polyamide	condensation polymerisation
C	polyester	addition polymerisation
D	polyester	condensation polymerisation

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9											5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
11 Na sodium 23	12 Mg magnesium 24											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium –	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89–103 actinoids	104 Rf rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

Key

atomic number
atomic symbol
name
relative atomic mass

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium –	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium –	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium –	94 Pu plutonium –	95 Am americium –	96 Cm curium –	97 Bk berkelium –	98 Cf californium –	99 Es einsteinium –	100 Fm fermium –	101 Md mendelevium –	102 No nobelium –	103 Lr lawrencium –

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).