Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/21**

Paper 2 Multiple Choice (Extended) **October/November 2017**

45 minutes

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

* 1 7 9 0 6 1 9 8 3 5 *

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 **15** printed pages and **1** blank page.

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1 Which process causes the greatest increase in the distance between particles?

A condensation

B freezing

C melting

D sublimation

2 A student put 25.0 cm^3 of dilute hydrochloric acid into a conical flask.

The student added 2.5 g of solid sodium carbonate and measured the change in temperature of the mixture.

Which apparatus does the student need to use to obtain the most accurate results?

A balance, measuring cylinder, thermometer

B balance, pipette, stopwatch

C balance, pipette, thermometer

D burette, pipette, thermometer

3 The results obtained from a chromatogram are shown.

	distance travelled / cm
solvent	5.0
substance X	3.0
substance Y	2.5

Which row gives the R_f values of substance X and substance Y?

	R_f (X)	R_f (Y)
A	0.5	0.6
B	0.6	0.5
C	1.6	2.0
D	2.0	1.6

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4 Two statements about silicon(IV) oxide are given.

1 It is a hard substance.

2 It has a macromolecular structure with strong covalent bonds.

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 not correct.

D Statement 2 is correct but statement 1 is not correct.

5 Which statement explains why isotopes of the same element have the same chemical properties?

A They have a different number of neutrons in the nucleus.

B They have the same number of neutrons in the nucleus.

C They have the same number of outer shell electrons.

D They have the same number of protons as neutrons.

6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of nitrogen?

A



B



C



D



7 The equation for the reaction between barium chloride solution and dilute sulfuric acid is shown.

$$BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$$

Which row shows the state symbols for this equation?

	$BaCl_2$	H_2SO_4	$BaSO_4$	$2HCl$
A	(aq)	(aq)	(s)	(aq)
B	(aq)	(l)	(s)	(aq)
C	(l)	(aq)	(s)	(l)
D	(aq)	(l)	(aq)	(l)

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[Turn over

8 A compound is analysed and found to contain 85.7% carbon and 14.3% hydrogen.

What is its empirical formula?

A CH **B** CH_2 **C** C_2H_4 **D** C_6H

9 Which statements about the electrolysis of concentrated copper(II) chloride are correct?

1 Electrons are transferred from the cathode to the copper(II) ions.

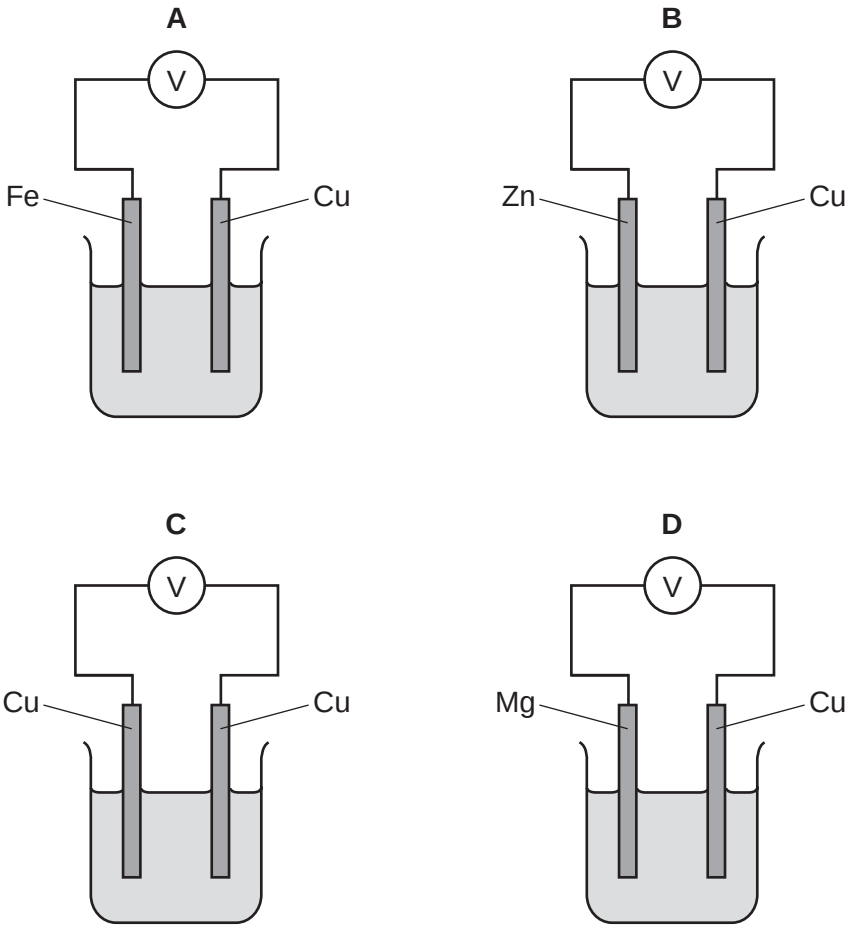
2 Electrons move round the external circuit from the cathode to the anode.

3 Chloride ions are attracted to the anode.

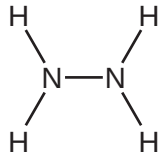
4 Hydroxide ions transfer electrons to the cathode.

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

10 Which metal combination produces the highest voltage reading in the cells shown?



11 The compound hydrazine is used as a rocket fuel. It has the structural formula shown.



One of the reactions of hydrazine is shown. This reaction is exothermic.

$$N_2H_4 \rightarrow N_2 + 2H_2$$

The bond energies are shown in the table.

	bond energy in kJ / mol
H–H	+436
N–H	+390
N–N	+160
N≡N	+945

What is the energy change for this reaction?

A –339 kJ / mol **B** –97 kJ / mol **C** +97 kJ / mol **D** +339 kJ / mol

12 Which statement describes an exothermic reaction?

A The energy absorbed for bond breaking is greater than the energy released by bond formation.

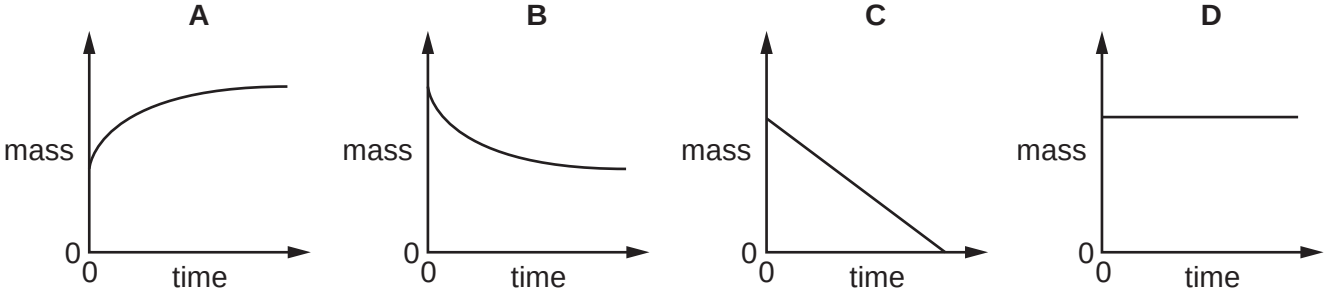
B The energy absorbed for bond breaking is less than the energy released by bond formation.

C The energy released by bond breaking is greater than the energy absorbed for bond formation.

D The energy released by bond breaking is less than the energy absorbed for bond formation.

13 The mass of a beaker and its contents is plotted against time.

Which graph represents what happens when sodium carbonate reacts with an excess of dilute hydrochloric acid in an open beaker?



14 Copper(II) oxide reacts with hydrogen.

$$CuO + H_2 \rightarrow Cu + H_2O$$

Which row is correct?

	oxidising agent	reducing agent
A	H_2	CuO
B	CuO	H_2
C	H_2O	Cu
D	Cu	H_2O

15 Ethanoic acid reacts slowly with calcium carbonate.

Which statements explain why an increase in temperature increases the rate of the reaction?

1 The activation energy of the reaction is decreased.

2 There is an increase in collision rate.

3 The particles have more energy.

4 There will be fewer successful collisions.

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

16 Methane reacts with steam to produce hydrogen and carbon monoxide.

The equation for the reaction is shown.

$$CH_4(g) + H_2O(g) \rightleftharpoons 3H_2(g) + CO(g)$$

The reaction is reversible. The forward reaction is endothermic.

Which changes in temperature and pressure increase the equilibrium yield of carbon monoxide?

	temperature	pressure
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

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17 Some properties of four oxides are listed.

Oxide 1 reacts with both acids and alkalis to form salts.

Oxide 2 reacts with acids to form salts but does not react with alkalis.

Oxide 3 reacts with alkalis to form salts but does not react with acids.

Oxide 4 does not react with acids or alkalis.

Which row describes the oxides?

	oxide 1	oxide 2	oxide 3	oxide 4
A	amphoteric	acidic	basic	neutral
B	amphoteric	basic	acidic	neutral
C	neutral	acidic	basic	amphoteric
D	neutral	basic	acidic	amphoteric

18 What is **not** a typical characteristic of acids?

A They react with alkalis producing water.

B They react with **all** metals producing hydrogen.

C They react with carbonates producing carbon dioxide.

D They turn blue litmus paper red.

19 Zinc sulfate is made by reacting an excess of zinc oxide with dilute sulfuric acid.

The excess zinc oxide is then removed from the solution.

Which process is used to obtain solid zinc sulfate from the solution?

A crystallisation

B dissolving

C filtration

D fractional distillation

20 What is used to test for chlorine?

A a glowing splint

B damp litmus paper

C limewater

D potassium manganate(VII) solution

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21 Which statements about the trends across a period of the Periodic Table are correct?

1 Aluminium is more metallic than sodium.

2 Beryllium is more metallic than carbon.

3 Boron is more metallic than lithium.

4 Magnesium is more metallic than silicon.

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

22 Astatine is an element in Group VII of the Periodic Table.

Astatine is .....1..... reactive than iodine.

The melting point of astatine is .....2..... than the melting point of iodine.

Astatine is .....3..... in colour than bromine.

Which words complete gaps 1, 2 and 3?

	1	2	3
A	less	higher	darker
B	less	lower	lighter
C	more	higher	darker
D	more	lower	lighter

23 Which row describes the properties of a typical transition element?

	melting point	forms coloured compounds	can act as a catalyst
A	high	no	no
B	high	yes	yes
C	low	no	yes
D	low	yes	no

24 Why is argon gas used to fill electric lamps?

A It conducts electricity.

B It glows when heated.

C It is less dense than air.

D It is not reactive.

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25 What is a property of **all** metals?

A conduct electricity

B hard

C low melting points

D react with water

26 Aluminium is extracted by the electrolysis of aluminium oxide.

Which statement is **not** correct?

A Aluminium ions are oxidised at the cathode.

B Carbon dioxide is made at the anode.

C Cryolite is added to lower the melting point of the aluminium oxide.

D The electrodes are made from graphite.

27 Which row describes how the metals are used?

	mixed with zinc to form brass	used to galvanise iron
A	aluminium	tin
B	aluminium	zinc
C	copper	tin
D	copper	zinc

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[Turn over

28 Information about the nitrates and carbonates of two metals, Q and R, is shown.

	appearance	solubility in water	effect of heat
nitrate of Q	white solid	soluble	colourless gas evolved which relights a glowing splint
carbonate of Q	white solid	soluble	no reaction
nitrate of R	white solid	soluble	brown gas evolved
carbonate of R	white solid	insoluble	colourless gas evolved which turns limewater milky

Which statement is correct?

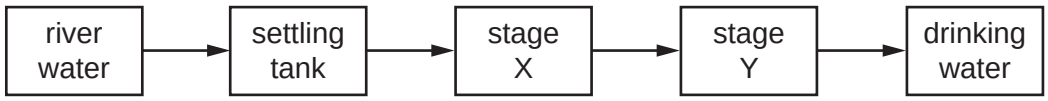
A Q is calcium and R is magnesium.

B Q is magnesium and R is sodium.

C Q is potassium and R is copper.

D Q is sodium and R is calcium.

29 The flow chart shows stages in the treatment of river water to produce drinking water.



What occurs at stages X and Y?

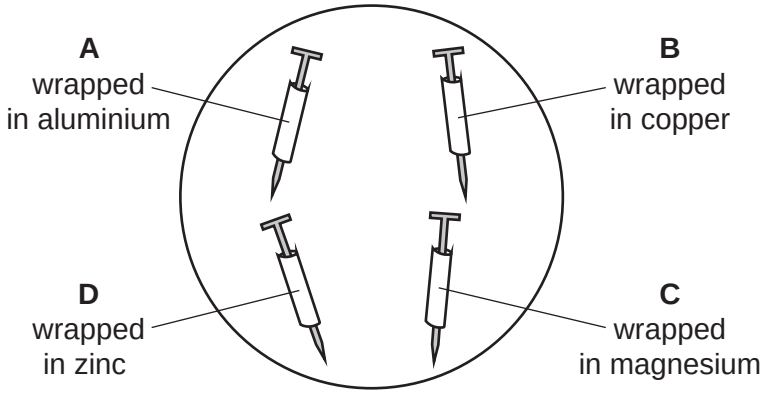
	X	Y
A	distillation	chlorination
B	distillation	filtration
C	filtration	chlorination
D	filtration	distillation

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30 Four iron nails had different metals wrapped around them.

The nails were placed in an open dish filled with water and left for a week.

Which iron nail has no protection against rusting?



31 Ammonia is made by the Haber process.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3$$

What are the sources of the nitrogen and hydrogen used in the Haber process?

	nitrogen	hydrogen
A	fertilisers	reacting methane with steam
B	fertilisers	the air
C	the air	reacting methane with steam
D	the air	the air

32 Which process does **not** produce carbon dioxide?

A combustion of alkanes

B photosynthesis

C respiration

D thermal decomposition of limestone

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[Turn over

33 Which row shows the conditions used in the manufacture of sulfuric acid by the Contact process?

	temperature / °C	pressure / atm	catalyst
A	40	200	Fe
B	40	200	V_2O_5
C	400	2	Fe
D	400	2	V_2O_5

34 Some marble chips (calcium carbonate) are heated strongly and substances X and Y are formed.

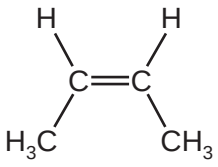
Substance X is a white solid that reacts with water, giving out heat. Substance Y is a colourless gas.

What are substances X and Y?

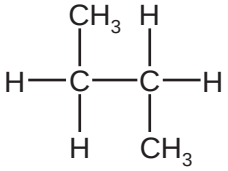
	X	Y
A	calcium chloride	oxygen
B	calcium hydroxide	carbon dioxide
C	calcium oxide	carbon dioxide
D	calcium sulfate	oxygen

35 The structures of some organic molecules are shown.

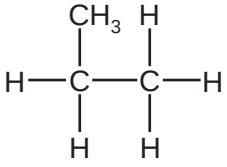
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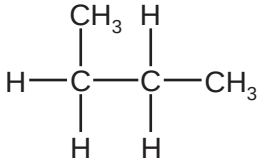
2



3



4



Which structures represent an alkane with four carbon atoms?

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

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36 Some of the fractions obtained from the fractional distillation of petroleum are used as fuels for vehicles.

Which two fractions are used as fuels for vehicles?

A bitumen fraction and gasoline fraction

B bitumen fraction and naphtha fraction

C gasoline fraction and kerosene fraction

D kerosene fraction and lubricating fraction

37 X, Y and Z are three hydrocarbons.

X $CH_2=CH_2$ Y $CH_3–CH=CH_2$ Z $CH_3–CH_2–CH=CH_2$

What do compounds X, Y and Z have in common?

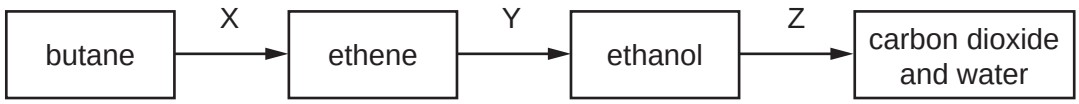
1 They are all alkenes.

2 They are all part of the same homologous series.

3 They all have the same boiling point.

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

38 The diagram shows a reaction sequence.



Which row names the processes X, Y and Z?

	X	Y	Z
A	cracking	fermentation	respiration
B	cracking	hydration	combustion
C	distillation	fermentation	respiration
D	distillation	hydration	combustion

39 Which pair of compounds can be used to prepare $CH_3CH_2COOCH_2CH_3$?

A ethanoic acid and ethanol

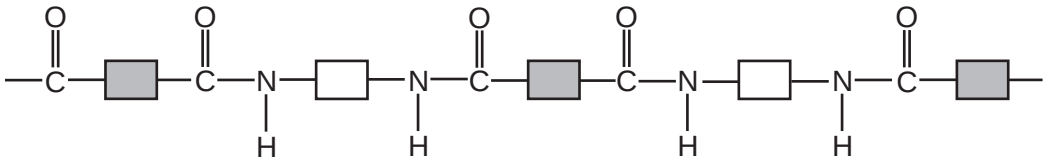
B ethanoic acid and propanol

C propanoic acid and ethanol

D propanoic acid and propanol

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40 The structure of a synthetic polymer is shown.



The structure shows that it is a .....1..... . It is formed by .....2..... polymerisation.

Which words complete gaps 1 and 2?

	1	2
A	polyamide	addition
B	polyamide	condensation
C	polyester	addition
D	polyester	condensation

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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.).