Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/21**

Paper 2 Multiple Choice (Extended) **October/November 2021**

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.

* 3 4 5 0 2 7 5 9 0 5 *

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1 Decane has a freezing point of –30 °C and a boiling point of 174 °C.

A small sample of decane is placed in an open beaker in an oven at a temperature of 120 °C and at atmospheric pressure for 24 hours.

What happens to the sample of decane?

A It boils.

B It evaporates.

C It melts.

D It sublimes.

2 A student put exactly 25.00 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?

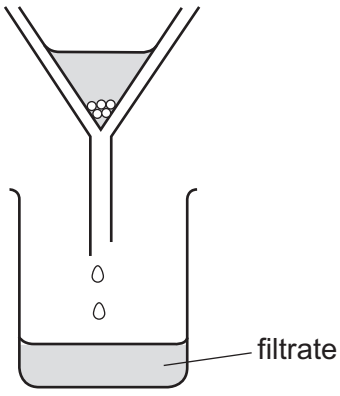
A balance, measuring cylinder, thermometer

B balance, pipette, stopwatch

C balance, pipette, thermometer

D burette, pipette, thermometer

3 A student separates sugar from pieces of broken glass by dissolving the sugar in water and filtering off the broken glass.



What is the filtrate?

A broken glass only

B broken glass and sugar solution

C pure water

D sugar solution

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4 Which statement explains why metals conduct electricity when solid?

A They have atoms which are free to move.

B They have electrons which are free to move.

C They have molecules which are free to move.

D They have positive ions which are free to move.

5 Which description of brass is correct?

A alloy

B compound

C element

D non-metal

6 The equation for the reaction of iron(III) oxide with carbon monoxide is shown.

$$Fe_2O_3(s) + 3CO(g) \rightarrow 2Fe(s) + 3CO_2(g)$$

What is the maximum mass of iron that can be made from 480 g of iron(III) oxide?

A 56 g **B** 112 g **C** 168 g **D** 336 g

7 Which statement describes the attractive forces between molecules?

A They are strong covalent bonds which hold molecules together.

B They are strong ionic bonds which hold molecules together.

C They are weak forces formed between covalently-bonded molecules.

D They are weak forces which hold ions together in a lattice.

8 Which statement about carbon is correct?

A Diamond and graphite both have simple molecular structures.

B Diamond and graphite are both used to make cutting tools.

C Each carbon atom in diamond is bonded to three other carbon atoms.

D Graphite conducts electricity and has a giant covalent structure.

9 The formula of an aluminium ion is Al^{3+}.

What is the formula of aluminium sulfate?

A Al_2SO_4 **B** $Al(SO_4)_2$ **C** $Al_2(SO_4)_3$ **D** $Al_3(SO_4)_2$

10 Which statements about the products of electrolysis, using inert electrodes, are correct?

1 When molten lead(II) bromide is electrolysed, bromine is formed at the cathode.

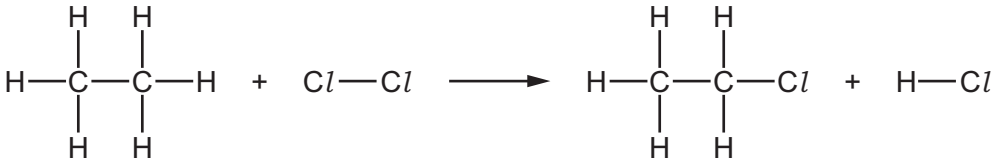
2 When dilute sulfuric acid is electrolysed, oxygen is formed at the anode.

3 When concentrated aqueous sodium chloride is electrolysed, sodium is formed at the cathode.

4 When concentrated hydrochloric acid is electrolysed, chlorine is formed at the anode.

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

11 Chlorine reacts with ethane to produce chloroethane and hydrogen chloride.



The reaction is exothermic.

The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–C*l*	+340
C–C	+350
C–H	+410
C*l*–C*l*	+240
H–C*l*	+430

What is the energy change for the reaction?

A –1420 kJ / mol

B –120 kJ / mol

C +120 kJ / mol

D +1420 kJ / mol

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12 Hydrogen is used as a fuel in rockets and is also used in hydrogen fuel cells.

Which statements are correct?

1 Both uses produce water vapour.

2 Burning hydrogen produces polluting gases.

3 A fuel cell produces electricity.

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

13 Which statements about the effect of increasing the temperature on the rate of a reaction are correct?

1 It increases the rate of a reaction.

2 It increases the activation energy.

3 It increases the frequency of collisions.

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

14 Ammonia is made by reacting nitrogen with hydrogen.

The equation for the reaction is shown.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

Which changes in temperature and pressure decrease the yield of ammonia?

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

15 X is a pink solid.

Y is a blue solid.

When X is heated, water is produced and the solid turns blue.

When water is added to Y, the solid turns pink.

What are X and Y?

	X	Y
A	anhydrous cobalt(II) chloride	hydrated cobalt(II) chloride
B	hydrated cobalt(II) chloride	anhydrous cobalt(II) chloride
C	anhydrous copper(II) sulfate	hydrated copper(II) sulfate
D	hydrated copper(II) sulfate	anhydrous copper(II) sulfate

16 Iron(II) chloride solution reacts with chlorine gas.

The equation is shown.

$$2FeCl_2(aq) + Cl_2(g) \rightarrow 2FeCl_3(aq)$$

Which statements about this reaction are correct?

1 Fe^{2+} ions are reduced to Fe^{3+} ions.

2 Chlorine acts as a reducing agent.

3 Fe^{2+} ions each lose an electron.

4 Cl_2 molecules are reduced to Cl^- ions.

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

17 Which row describes the properties of an acid?

	property 1	property 2
A	proton acceptor	pH less than 7
B	proton acceptor	pH more than 7
C	proton donor	pH less than 7
D	proton donor	pH more than 7

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18 Which element forms an amphoteric oxide?

A aluminium

B carbon

C magnesium

D silicon

19 Copper(II) chloride crystals are made by adding solid copper(II) carbonate to dilute hydrochloric acid until no more dissolves.

Which process is used to obtain pure copper(II) chloride crystals from the mixture?

A distillation of the mixture

B evaporation of the mixture

C filtration followed by drying of the residue

D filtration followed by evaporation of the filtrate

20 Moving from right to left across the Periodic Table the elements show increasing metallic character.

Why does metallic character increase from right to left across a period?

A The atoms have more electrons in their outer shells.

B The atoms more readily gain electrons to form negative ions.

C The atoms more readily lose electrons to form positive ions.

D The charge on the nucleus of each atom gets larger.

21 A period of the Periodic Table is shown.

group	I	II	III	IV	V	VI	VII	VIII
element	R	S	T	V	W	X	Y	Z

The letters are not their chemical symbols.

Which statement is correct?

A Element R does not conduct electricity.

B Elements R and Y react together to form an ionic compound.

C Element Z exists as a diatomic molecule.

D Element Z reacts with element T.

22 Group VII elements show trends in their physical properties going down the group.

element	X	Y	Z
chlorine	–101	–34	0.003
bromine	–7	59	3.1
iodine	114	184	4.9

Which row shows the missing headings for the properties in the table?

	X	Y	Z
A	density in g / cm^3	boiling point in °C	melting point in °C
B	melting point in °C	boiling point in °C	density in g / cm^3
C	boiling point in °C	density in g / cm^3	melting point in °C
D	boiling point in °C	melting point in °C	density in g / cm^3

23 Some properties of two metals, G and H, are shown.

metal G	metal H
the formula of the chloride is GCl	high melting point
reacts with cold water	has more than one oxidation state

Which row about metals G and H is correct?

	metal G	metal H
A	in Group I of the Periodic Table	in Group II of the Periodic Table
B	in Group I of the Periodic Table	transition metal
C	in Group II of the Periodic Table	in Group I of the Periodic Table
D	in Group II of the Periodic Table	transition metal

24 The noble gases are in Group VIII of the Periodic Table.

Which statement explains why noble gases are unreactive?

A They all have eight electrons in their outer shells.

B They all have full outer shells.

C They are all gases.

D They are all monoatomic.

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25 Which statement is correct for **all** metals?

A They conduct electricity when molten.

B They gain electrons when they form ions.

C They have a low density.

D They have a low melting point.

26 Which statement about the extraction of metals is correct?

A Aluminium is extracted from the ore bauxite by electrolysis.

B Aluminium is extracted from the ore hematite by electrolysis.

C Iron is extracted from the ore bauxite by electrolysis.

D Iron is extracted from the ore hematite by electrolysis.

27 Aluminium objects do not need protection from corrosion.

Iron objects must be protected from corrosion.

Which statement explains why aluminium resists corrosion?

A Aluminium does not form ions easily.

B Aluminium does not react with water or air.

C Aluminium has a protective oxide layer.

D Aluminium is below iron in the reactivity series.

28 Which statements about the thermal decomposition of copper(II) nitrate are correct?

1 A brown gas is given off.

2 A gas which relights a glowing splint is given off.

3 The solid residue is an acidic oxide.

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

29 Covering iron with zinc prevents the iron from rusting even when the zinc is scratched.

Covering iron with tin prevents the iron from rusting, but when the tin is scratched the iron underneath starts to rust.

Which statement is correct?

A Both tin and zinc prevent iron from rusting by sacrificial protection.

B Both tin and zinc prevent iron from rusting by stopping water and carbon dioxide reaching the iron.

C Tin is more reactive than iron and prevents iron from rusting until it is scratched.

D Zinc loses electrons more easily than iron and prevents iron from rusting by corroding first.

30 Which statements about the Haber process are correct?

1 One of the raw materials is extracted from liquid air by fractional distillation.

2 One of the raw materials is produced by the reaction of steam and methane.

3 The catalyst for the Haber process is vanadium(V) oxide.

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

31 Which raw material is used in the Contact process?

A air

B ammonia

C carbon

D nitrogen

32 Lime (calcium oxide) is used to treat waste water from a factory.

Which substance is removed by the lime?

A ammonia

B sodium chloride

C sodium hydroxide

D sulfuric acid

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33 An alkane molecule of molecular formula C_8H_{18} undergoes cracking. The equation for the reaction is shown.

$$C_8H_{18} \rightarrow Q + 2R$$

Substance R has two carbon atoms per molecule and decolourises aqueous bromine.

What is substance Q?

A butane

B butene

C ethane

D ethene

34 Fuel X produces carbon dioxide and water when it is burned in air. So does fuel Y.

What could X and Y be?

	X	Y
A	C	H_2
B	C	C_8H_{18}
C	CH_4	H_2
D	CH_4	C_8H_{18}

35 Which molecule contains only single covalent bonds?

A propane

B propanoic acid

C propene

D propyl propanoate

36 Alkanes react with chlorine to form chloroalkanes.

Which statement about the reactions of alkanes with chlorine is correct?

A Alkanes react with chlorine by addition.

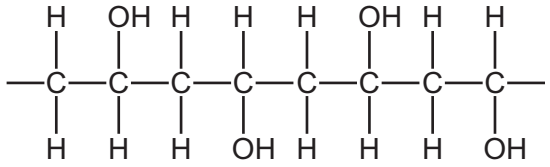
B The gaseous product turns red litmus blue.

C The chlorine atom in chloroethane is covalently bonded.

D The general formula of the chloroalkanes is $C_nH_{2n}Cl$.

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37 Part of the structure of a very large molecule is shown.



Which term describes the small unit used to make this molecule?

A hydrocarbon

B monomer

C polymer

D saturated

38 Propene reacts with steam to form propanol.

$$C_3H_6(g) + H_2O(g) \rightarrow C_3H_7OH(g)$$

Which type of reaction takes place?

A addition

B condensation

C oxidation

D substitution

39 Which statement about aqueous ethanoic acid is correct?

A It reacts with magnesium to produce a salt and hydrogen.

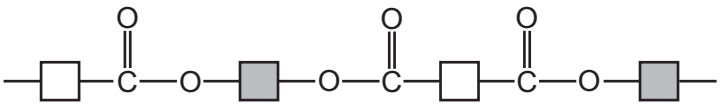
B It reacts with sodium hydroxide to produce a salt and hydrogen.

C It reacts with ammonium salts to produce ammonia.

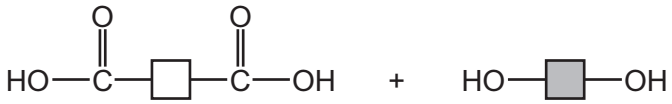
D It turns red litmus blue.

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40 The diagram shows the partial structure of *Terylene*.



From which pair of compounds is it made?

A 

B 

C 

D 

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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.).