Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/23**

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.

IB21 11_0620_23/3RP

[Turn over

1 Brownian motion and the diffusion of gases provide evidence for the particulate nature of matter.

Which row identifies an example of Brownian motion and how molecular mass determines the rate of diffusion of gas molecules?

	Brownian motion	diffusion
A	pollen grains in water are seen to move randomly	heavier gas molecules diffuse more quickly
B	pollen grains in water are seen to move randomly	lighter gas molecules diffuse more quickly
C	salt dissolves faster in hot water than in cold water	heavier gas molecules diffuse more quickly
D	salt dissolves faster in hot water than in cold water	lighter gas molecules diffuse more quickly

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?

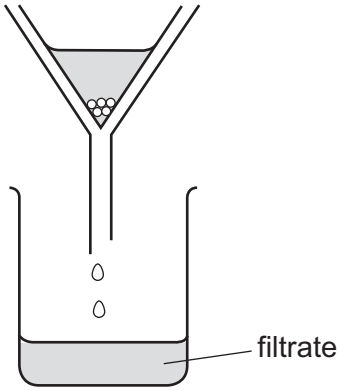
A balance, measuring cylinder, thermometer

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

4 The nucleus of a particular atom consists of nineteen particles.

Nine of them are positively charged and ten of them are uncharged.

Which statement about this nucleus is correct?

A The nucleus has a nucleon number of nine.

B The nucleus has a nucleon number of ten.

C The nucleus has a proton number of nine.

D The nucleus has a proton number of ten.

5 Which description of brass is correct?

A alloy

B compound

C element

D non-metal

6 A Group I element combines with a Group VII element and forms an ionic bond.

Which row shows how the electronic structures change?

	Group I element		Group VII element	
	before bonding	after bonding	before bonding	after bonding
A	2,8,1	2,8,2	2,7	2,6
B	2,8	2,7	2,8	2,8,1
C	2,8,1	2,8	2,7	2,8
D	2,8	2,8,1	2,8	2,7

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 diagram shows the outer electron arrangement in a molecule of carbon dioxide?

A

B

C

D

9 Aluminium oxide is an ionic compound containing Al^{3+} ions and O^{2-} ions.

Aluminium hydroxide is an ionic compound containing Al^{3+} ions and OH^- ions.

In which row are the formulae for aluminium oxide and aluminium hydroxide correct?

	aluminium oxide	aluminium hydroxide
A	Al_2O_3	$Al(OH)_3$
B	Al_3O_2	$AlOH_3$
C	Al_2O_3	$AlOH_3$
D	Al_3O_2	$Al(OH)_3$

10 Effervescence is observed at the negative electrode (cathode) during the electrolysis of concentrated aqueous sodium chloride.

Which element is produced at the negative electrode (cathode)?

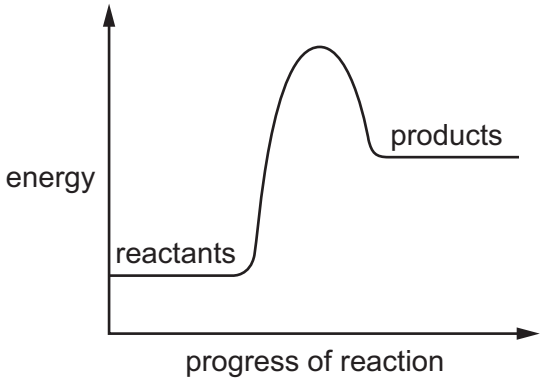
A chlorine

B hydrogen

C oxygen

D sodium

11 The energy level diagram for a chemical reaction is shown.



Which statement about this reaction is correct?

A The reaction is endothermic and energy is given out to the surroundings.

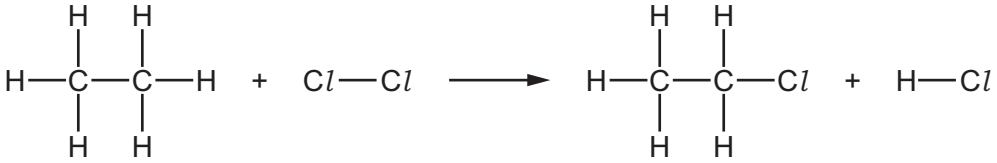
B The reaction is endothermic and energy is taken in from the surroundings.

C The reaction is exothermic and energy is given out to the surroundings.

D The reaction is exothermic and energy is taken in from the surroundings.

[Turn over

12 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

13 What is the concentration of the solution when 31.8 g of sodium carbonate, Na_2CO_3, is dissolved in water to make a solution of 250 cm^3?

A 0.075 mol / dm^3

B 0.30 mol / dm^3

C 1.2 mol / dm^3

D 1.5 mol / dm^3

14 A fuel cell is used to generate electricity.

Which chemicals are used in a fuel cell?

A hydrogen and methane

B hydrogen and oxygen

C nitrogen and methane

D nitrogen and oxygen

15 Sulfuric acid is manufactured using the Contact process. One of the reactions is shown.

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

The forward reaction is exothermic.

statement 1 The equation has more molecules on the left-hand side than on the right-hand side.

statement 2 Using a higher pressure shifts the equilibrium to the left.

statement 3 Higher temperatures increase the rate of reaction.

statement 4 Increasing the temperature shifts the equilibrium to the right.

Which alternative is correct?

A Statement 1 is correct and explains statement 2.

B Statement 1 and statement 3 are correct.

C Statement 2 and statement 4 are correct.

D Statement 3 is correct and explains statement 4.

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.

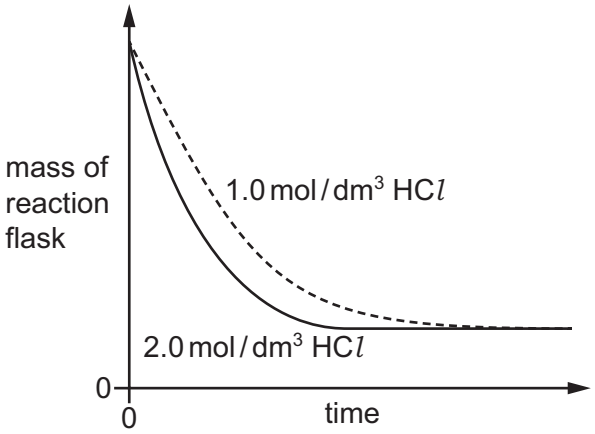
4 Cl_2 molecules are reduced to Cl^- ions.

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

17 Excess dilute hydrochloric acid is added to equal masses of powdered calcium carbonate in two separate experiments.

Two different concentrations of hydrochloric acid are used. The temperature in both experiments is the same.

The results show the change in mass of the reaction flask measured over time.



Why is the rate of reaction for the 1.0 mol / dm^3 hydrochloric acid slower?

	collision energy	collision rate
A	lower	higher
B	lower	lower
C	same as for 2.0 mol / dm^3	higher
D	same as for 2.0 mol / dm^3	lower

18 Basic oxides are neutralised by acidic oxides.

Which element forms an oxide that neutralises calcium oxide?

A hydrogen

B magnesium

C sodium

D sulfur

19 Four solid oxides are added to dilute hydrochloric acid and aqueous sodium hydroxide.

Which row describes an amphoteric oxide?

	hydrochloric acid	sodium hydroxide
A	✓	✓
B	✗	✓
C	✓	✗
D	✗	✗

key

✓ = reacts

✗ = does not react

20 Which row describes an acid and an oxidising agent?

	acid	oxidising agent
A	proton acceptor	electron acceptor
B	proton acceptor	electron donor
C	proton donor	electron acceptor
D	proton donor	electron donor

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?

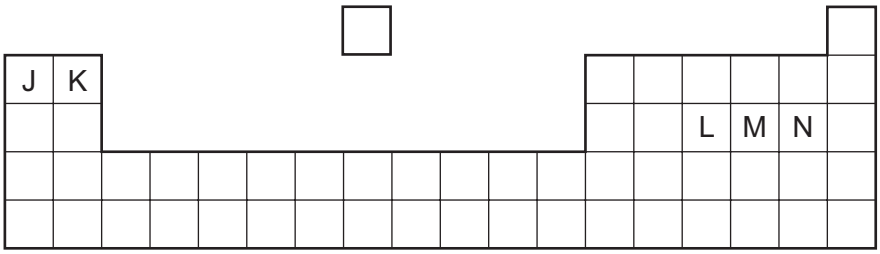
A Element R does not conduct electricity.

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 Part of the Periodic Table is shown.



Which pairs of the elements J, K, L, M and N react together to form a product with a 1 : 1 ratio?

A J and L K and M

B J and M K and N

C J and N K and L

D J and N K and M

23 Which property is shown by transition metals but **not** shown by Group I metals?

A good electrical conductivity

B good thermal conductivity

C loss of electrons to form positive ions

D variable oxidation states

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.

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 Chromium is a more reactive metal than iron but less reactive than zinc.

Which statements are correct?

1 Chromium does not react with dilute hydrochloric acid.

2 Chromium oxide is reduced when it is heated with carbon.

3 Chromium reacts with zinc oxide to form zinc.

4 Chromium reacts with steam to form hydrogen gas.

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

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 statement describes how oxides of nitrogen are formed in a car engine?

A Nitrogen from the air reacts with oxygen from petrol.

B Nitrogen from the air reacts with oxygen from the air.

C Nitrogen from petrol reacts with oxygen from petrol.

D Nitrogen from petrol reacts with oxygen from the air.

29 Ships are made of steel, an alloy of iron.

Blocks of magnesium are attached to the underside of ships to prevent rusting.

Which statement explains how the magnesium prevents rusting?

A Magnesium oxidises instead of iron.

B Magnesium stops air and water getting to the iron.

C The magnesium forms an alloy with iron which does not corrode.

D The magnesium reacts with rust as soon as it is formed.

30 Which process is used to produce hydrogen for the Haber process?

A electrolysis of water

B reacting aluminium with sodium hydroxide

C reacting iron with sulfuric acid

D reacting methane with steam

31 One of the steps in manufacturing sulfuric acid in the Contact process is shown.

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

Which catalyst is used to increase the rate of this reaction?

A aluminium oxide

B iron

C phosphoric acid

D vanadium(V) oxide

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

Which substance is removed by the lime?

A ammonia

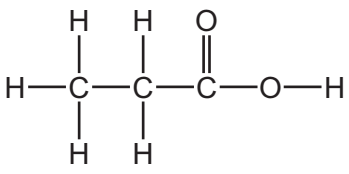
B sodium chloride

C sodium hydroxide

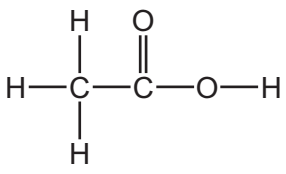
D sulfuric acid

33 What is the structure of propanol?

A



B



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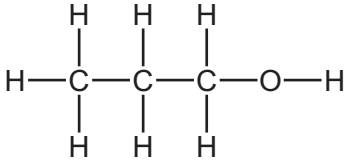
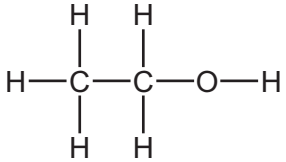


D



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 What is the main constituent of natural gas?

A hydrogen

B carbon monoxide

C methane

D nitrogen

36 Which statement describes the members of a homologous series?

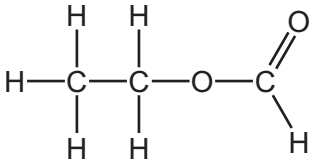
A compounds with the same physical properties

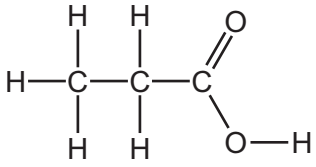
B compounds containing the same functional group

C compounds containing the same number and type of bonds

D compounds obtained from the same raw material

37 The structures of two compounds are shown.





Which statements about these compounds are correct?

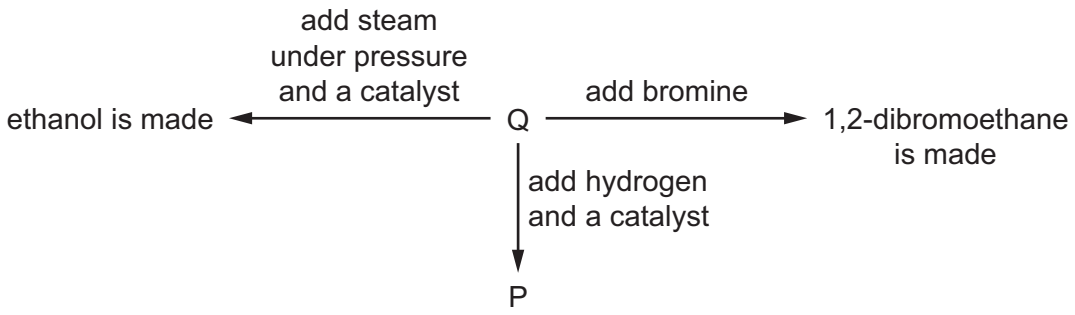
1 They have the same molecular formula.

2 They have similar chemical properties.

3 They are structural isomers.

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

38 Some reactions of substance Q are shown.



What is P?

A ethane

B ethanoic acid

C ethene

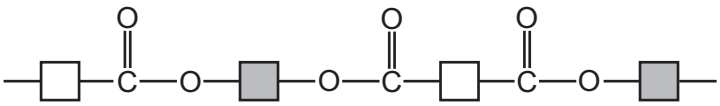
D poly(ethene)

39 Proteins and starch are natural polymers.

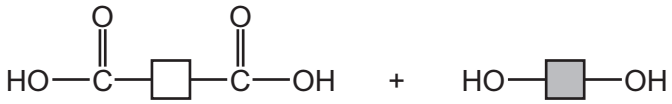
Which row identifies the method of polymerisation of proteins and starch?

	proteins	starch
A	addition	addition
B	condensation	condensation
C	addition	condensation
D	condensation	addition

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



From which pair of compounds is it made?

A 

B 

C 

D 

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.).