Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **February/March 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 03_0620_22/3RP

1 Which row about a change of state is correct?

	change of state	energy change	process
A	solid → liquid	heat given out	melting
B	gas → liquid	heat taken in	evaporation
C	solid → gas	heat taken in	sublimation
D	liquid → solid	heat given out	condensing

2 Gases are separated from liquid air by fractional distillation.

The boiling points of four gases are shown.

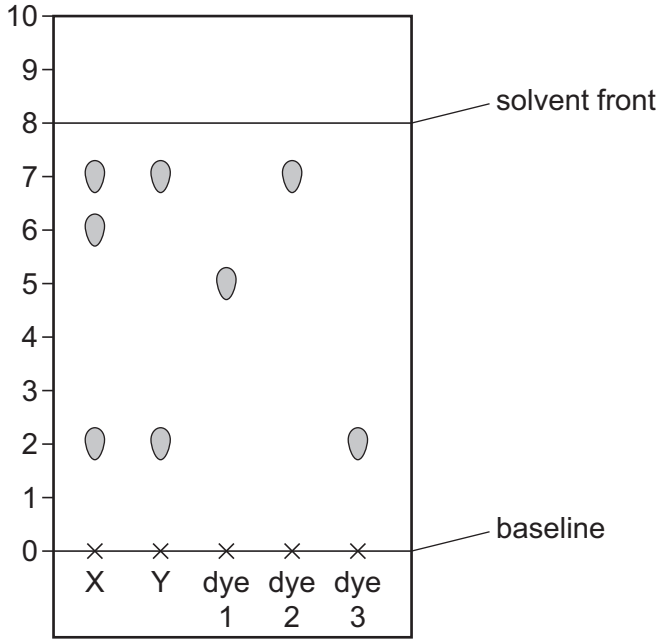
Which gas is both monoatomic and a liquid at –200 °C?

	gas	boiling point / °C
A	argon	–186
B	helium	–269
C	neon	–246
D	nitrogen	–196

3 Two different food colourings, X and Y, are tested using chromatography.

Three pure dyes, 1, 2 and 3, are also tested.

The chromatogram is shown.



Which statements are correct?

1 X and Y both contain two or more dyes.

2 Dyes 2 and 3 are present in both X and Y.

3 The R_f of dye 1 is 0.625.

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

4 Which statement about the atoms of all the isotopes of carbon is correct?

A They are all radioactive.

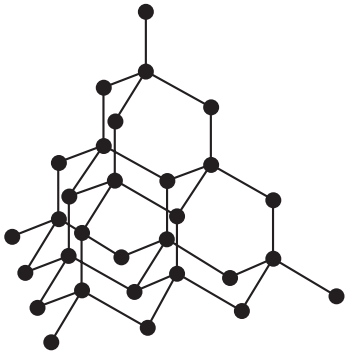
B They have the same mass.

C They have the same number of neutrons.

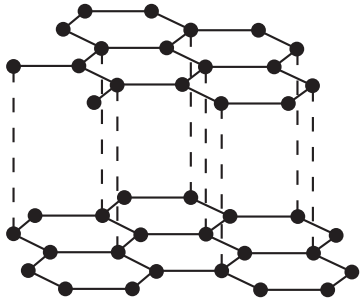
D They have the same number of electrons in the outer shell.

5 Which diagram represents the structure of silicon(IV) oxide?

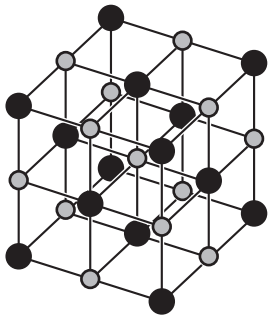
A



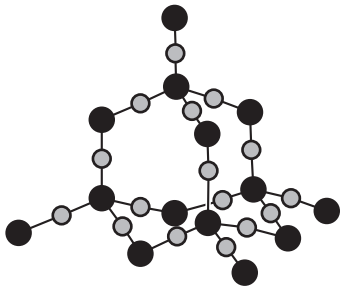
B



C



D



6 Lithium and fluorine react to form lithium fluoride.

A student writes three statements about the reaction.

1 Lithium atoms lose an electron when they react.

2 Each fluoride ion has one more electron than a fluorine atom.

3 Lithium fluoride is a mixture of elements.

Which statements are correct?

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

7 How many electrons are used to form covalent bonds in a molecule of methanol, CH_3OH?

A 5 **B** 6 **C** 8 **D** 10

8 Magnesium oxide has a high melting point.

Carbon dioxide has a low melting point.

Which row identifies the attractive forces that are broken when these compounds are melted?

	magnesium oxide	carbon dioxide
A	strong attractions between molecules	weak attractions between atoms
B	strong attractions between molecules	weak attractions between molecules
C	strong attractions between ions	weak attractions between atoms
D	strong attractions between ions	weak attractions between molecules

9 The ionic half-equation for the formation of oxygen during the electrolysis of aluminium oxide is shown.

$$x O^{2-} \rightarrow O_2 + y e^-$$

What are the values of *x* and *y*?

	x	*y*
A	1	2
B	1	4
C	2	2
D	2	4

10 A compound has the formula XF_2 and has a relative mass of 70.

What is element X?

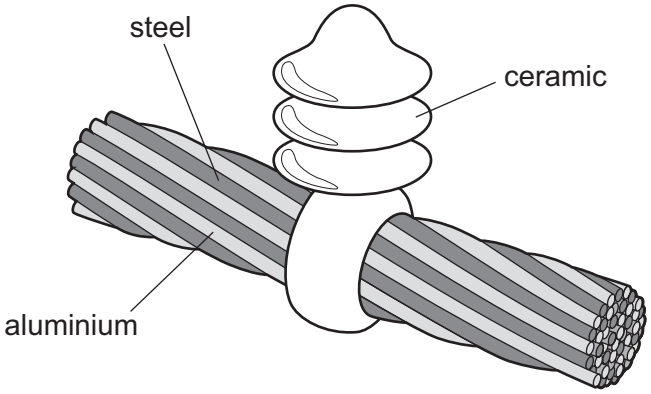
A gallium

B germanium

C sulfur

D ytterbium

11 The diagram shows a section of an overhead power cable.



Which statement explains why a particular substance is used?

A Aluminium has a low density and is a good conductor of electricity.

B Ceramic is a good conductor of electricity.

C Steel can rust in damp air.

D Steel is more dense than aluminium.

12 During the electrolysis of dilute sulfuric acid, hydrogen is collected at the cathode.

What is the ionic half-equation for this reaction?

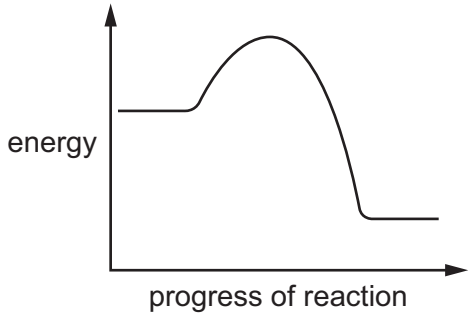
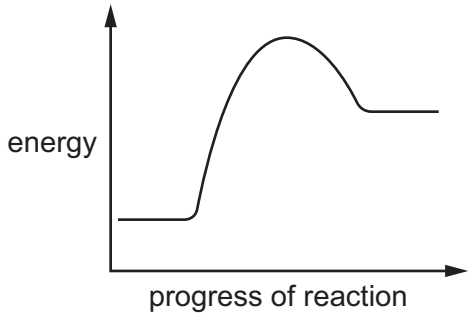
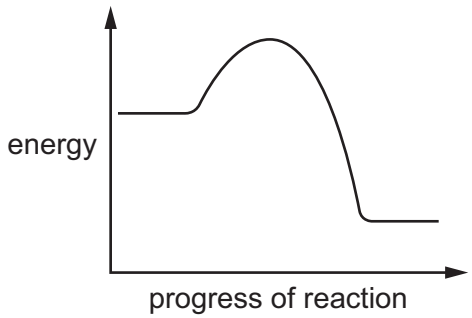
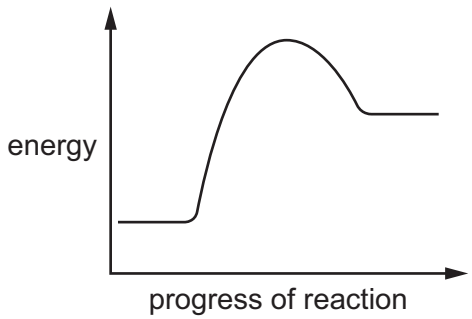
A $H^+ + e^- \rightarrow H$

B $H^+ \rightarrow H + e^-$

C $2H^+ + 2e^- \rightarrow H_2$

D $2H^+ \rightarrow H_2 + 2e^-$

13 Which row describes an endothermic reaction?

	energy level diagram	energy transfer
A		energy is transferred from the surroundings to the reaction
B		energy is transferred from the surroundings to the reaction
C		energy is transferred from the reaction to the surroundings
D		energy is transferred from the reaction to the surroundings

[Turn over

14 The equation for the complete combustion of methane is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–H	+410
C=O	+805
O–H	+460
O=O	+496

What is the energy change for the reaction?

A –818 kJ / mol **B** –359 kJ / mol **C** –323 kJ / mol **D** +102 kJ / mol

15 Hydrogen fuel cells can be used to power cars.

Which statements about a fuel cell are correct?

1 The balanced equation for the reaction is $H_2 + O_2 \rightarrow H_2O$.

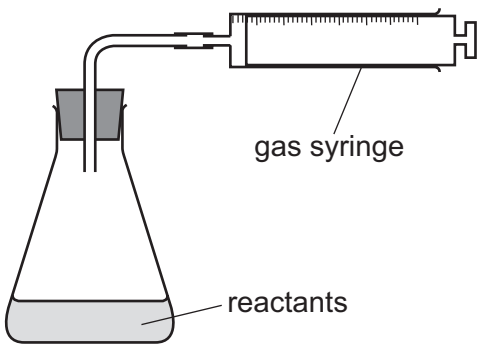
2 The fuel cell generates electricity.

3 In the fuel cell hydrogen is reduced.

4 The reactants are gases at room temperature.

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

16 The apparatus shown is used to measure the rate of a reaction.



Which equation represents a reaction where the rate can be measured using this apparatus?

A $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$

B $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

C $Fe(s) + CuSO_4(aq) \rightarrow Cu(s) + FeSO_4(aq)$

D $2Na(s) + Br_2(l) \rightarrow 2NaBr(s)$

17 P is a hydrated metal salt with a blue colour. When P is heated, water is given off, leaving solid Q.

R is a hydrated metal salt with a pink colour. When R is heated, water is given off, leaving solid S.

Which row gives the name of P and the colour of S?

	name of P	colour of S
A	hydrated cobalt(II) chloride	blue
B	hydrated cobalt(II) chloride	white
C	hydrated copper(II) sulfate	blue
D	hydrated copper(II) sulfate	white

18 Magnesium reacts with copper(II) oxide to give magnesium oxide and copper.

Which substance is the oxidising agent in this reaction?

A copper

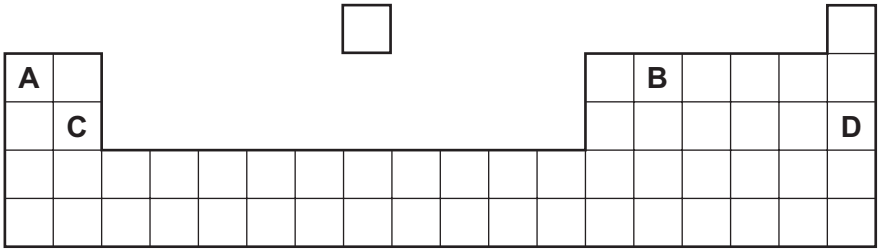
B copper(II) oxide

C magnesium

D magnesium oxide

19 Part of the Periodic Table is shown.

Which element forms an acidic oxide?



20 When aqueous sodium hydroxide is added to a solution of a metal ion, a grey-green precipitate forms, which dissolves in excess to form a dark green solution.

What is the identity of the metal ion?

A chromium(III)

B iron(II)

C iron(III)

D copper(II)

21 Which statements about strong acids are correct?

1 They have a high concentration of OH^- ions.

2 They have a pH value of 1.

3 They completely ionise in water.

4 They turn red litmus blue.

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

22 Metal X reacts with non-metal Y to form an ionic compound with the formula X_2Y.

Which statements are correct?

1 X is in Group I of the Periodic Table.

2 X is in Group II of the Periodic Table.

3 Y is in Group VI of the Periodic Table.

4 Y is in Group VII of the Periodic Table.

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

23 The table gives some properties of Group IV elements.

element	density / g / cm^3	boiling point / °C
carbon	2.2	4827
silicon		
germanium	5.3	2830
tin	5.8	2270
lead	11.3	1755

Which row describes the properties of silicon?

	density / g / cm^3	boiling point / °C
A	2.3	3 265
B	3.1	1 997
C	6.2	2 920
D	24.6	11 682

24 The metal beryllium does not react with cold water.

It reacts with hydrochloric acid but cannot be extracted from its ore by using carbon.

Where is beryllium placed in the reactivity series?

magnesium
A
zinc
B
iron
C
copper
D

25 Why is cryolite used in the extraction of aluminium from bauxite?

A as a catalyst for the process

B as a solvent for aluminium oxide

C it stops the carbon anodes burning away

D it reduces aluminium ions in aluminium oxide

[Turn over

26 Which statements about the uses of metals are correct?

1 Iron is used to make aircraft because iron has a low density.

2 Copper is used to make electric cables because copper is a good conductor of electricity.

3 Aluminium is used to make brass because aluminium is strong and hard.

4 Iron is mixed with additives to make an alloy used in chemical plant.

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

27 Which row describes the reactions of magnesium hydroxide and magnesium oxide?

	effect of heat on hydroxide	effect of heating oxide with carbon
A	forms magnesium oxide	magnesium and carbon dioxide formed
B	forms magnesium oxide	no reaction
C	no reaction	magnesium and carbon dioxide formed
D	no reaction	no reaction

28 The properties of an element are listed.

Its melting point is 3414 °C.

Some of its compounds are catalysts.

It has variable oxidation states.

Where is the element found in the Periodic Table?

A alkali metals

B halogens

C noble gases

D transition elements

29 Petrol burns in a car engine to produce waste gases which leave through the car exhaust.

One of these waste gases is an oxide of nitrogen.

Which statement describes how this oxide of nitrogen is formed?

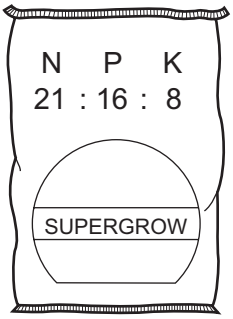
A Carbon dioxide reacts with nitrogen in the catalytic converter.

B Nitrogen reacts with oxygen in the car engine.

C Nitrogen reacts with oxygen in the catalytic converter.

D Petrol combines with nitrogen in the car engine.

30 Which combination of chemical compounds can be used to produce the fertiliser shown?



A $(NH_4)_3PO_4$, KCl

B NH_4NO_3, $Ca_3(PO_4)_2$

C NH_4NO_3, $CO(NH_2)_2$

D NH_4NO_3, K_2SO_4, $(NH_4)_2SO_4$

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

A combustion of a hydrocarbon

B photosynthesis

C reaction between an acid and a metal carbonate

D respiration

32 Which substance is used as a bleach in the manufacture of paper?

A carbon dioxide

B nitrogen dioxide

C silicon dioxide

D sulfur dioxide

33 What is an industrial use of calcium carbonate?

A cracking of hydrocarbons

B manufacture of aluminium

C manufacture of cement

D purification of water

[Turn over

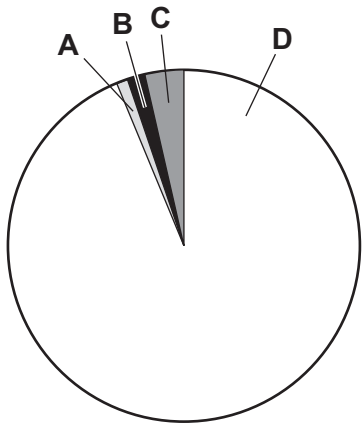
34 Propane reacts with chlorine.

Which row shows a condition required for this reaction and identifies the type of reaction?

	condition	type of reaction
A	phosphoric acid catalyst	addition
B	phosphoric acid catalyst	substitution
C	ultraviolet light	addition
D	ultraviolet light	substitution

35 The pie chart represents the composition of natural gas.

Which sector represents methane?



36 Which statement describes the reaction between ethene and steam?

A a cracking reaction which produces ethane and hydrogen gas as products

B an addition reaction which produces ethanol as the only product

C an oxidation reaction which produces ethanoic acid as the only product

D a slow reaction producing ethanol and carbon dioxide

37 The formula of a hydrocarbon is C_xH_y.

The equation for its complete combustion is shown.

$$C_xH_y + 8O_2 \rightarrow 5CO_2 + 6H_2O$$

What are the values of x and y?

	x	y
A	5	6
B	5	12
C	6	5
D	12	5

38 The formula of an ester is $CH_3CH_2CH_2COOCH_2CH_2CH_3$.

Which acid and alcohol react together to make the ester?

	acid	alcohol
A	butanoic acid	butanol
B	butanoic acid	propanol
C	propanoic acid	butanol
D	propanoic acid	propanol

39 Molecule 1 undergoes a process to make molecule 2.

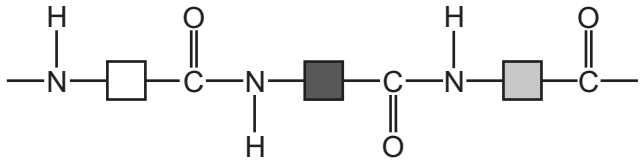
$$\text{molecule 1} \xrightarrow{\text{process}} \text{molecule 2}$$

Which row describes the molecules and the process?

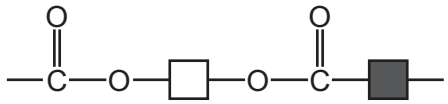
	molecule 1	process	molecule 2
A	monomer	cracking	polymer
B	monomer	polymerisation	polymer
C	small molecule	polymerisation	monomer
D	small molecule	cracking	monomer

40 Which structure represents a protein?

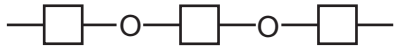
A



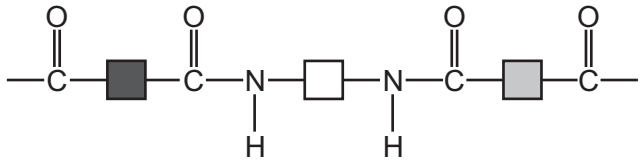
B



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.).