Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **May/June 2019**

45 minutes

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

* 9 6 5 9 2 3 0 4 9 9 7 *

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 20.
Electronic calculators may be used.

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

This document consists of **17** printed pages and **3** blank pages.

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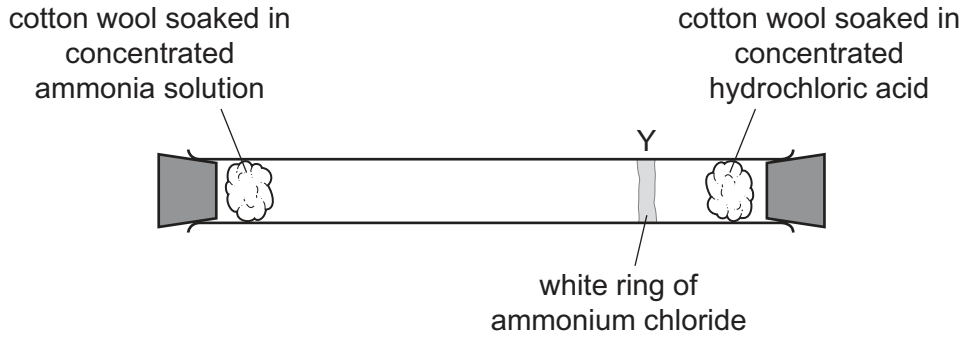
1 The apparatus shown is set up. After 20 minutes a white ring of ammonium chloride is seen at position Y.



Which statement about the molecules of ammonia and hydrogen chloride is correct?

A Molecules in ammonia have a larger M_r than molecules of hydrogen chloride and so they move more slowly.

B Molecules in ammonia have a larger M_r than molecules of hydrogen chloride and so they move more quickly.

C Molecules in ammonia have a smaller M_r than molecules of hydrogen chloride and so they move more slowly.

D Molecules in ammonia have a smaller M_r than molecules of hydrogen chloride and so they move more quickly.

2 A student measures 25.00 cm^3 of dilute hydrochloric acid accurately.

Which apparatus is most suitable?

A beaker

B measuring cylinder

C burette

D dropping pipette

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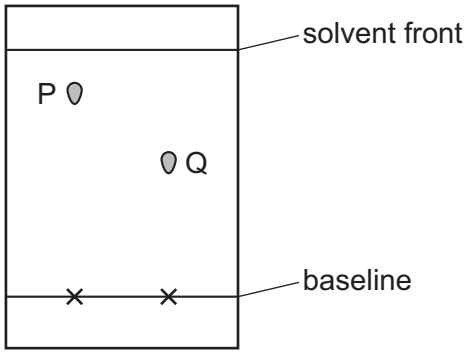
3 The chromatogram of solutions of two metal ions, P and Q, is shown.



P is coloured. A locating agent is used to find the position of Q.

The R_f value of each solution is calculated.

P is a .....1..... element and has an R_f value .....2..... than that of Q.

Which words complete gaps 1 and 2?

	1	2
A	non-transition	greater
B	non-transition	smaller
C	transition	greater
D	transition	smaller

4 What is an isotope of $^{31}_{15}E$?

A $^{31}_{14}E$ **B** $^{33}_{15}E$ **C** $^{31}_{16}E$ **D** $^{33}_{16}E$

5 Which row describes the formation of single covalent bonds in methane?

A	atoms share a pair of electrons	both atoms gain a noble gas electronic structure
B	atoms share a pair of electrons	both atoms have the same number of electrons in their outer shell
C	electrons are transferred from one atom to another	both atoms gain a noble gas electronic structure
D	electrons are transferred from one atom to another	both atoms have the same number of electrons in their outer shell

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6 Which statement describes the structure of an ionic compound?

A It is a giant lattice of oppositely charged ions.

B It is a giant lattice of positive ions in a 'sea' of electrons.

C It is a giant molecule of oppositely charged ions.

D It is a simple molecule of oppositely charged ions.

7 Calcium metal reacts with water to form a solution of calcium hydroxide and hydrogen gas.

Which equation is correct?

A $Ca(s) + H_2O(aq) \rightarrow CaOH(aq) + H(g)$

B $Ca(s) + 2H_2O(aq) \rightarrow Ca(OH)_2(s) + 2H_2(g)$

C $Ca(s) + 2H_2O(l) \rightarrow Ca(OH)_2(aq) + H_2(g)$

D $Ca(s) + H_2O(l) \rightarrow CaOH(l) + H(g)$

8 $25.0\,cm^3$ of $0.100\,mol/dm^3$ aqueous sodium hydroxide is neutralised by $24.6\,cm^3$ of dilute sulfuric acid.

What is the concentration of the dilute sulfuric acid?

A $0.0508\,mol/dm^3$

B $0.0984\,mol/dm^3$

C $0.102\,mol/dm^3$

D $0.203\,mol/dm^3$

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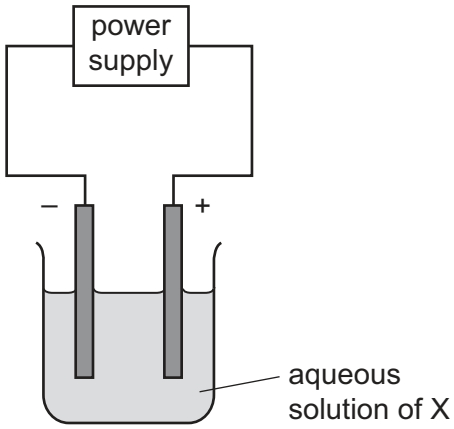
9 The diagram shows the electrolysis of an aqueous solution of X using inert electrodes.



Hydrogen is produced at the cathode and chlorine is produced at the anode.

What is X?

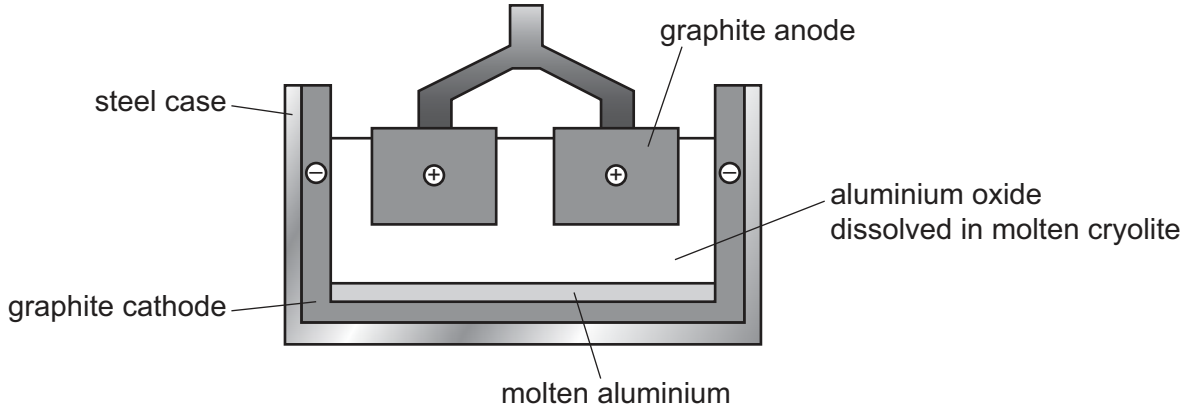
A concentrated copper(II) chloride solution

B concentrated hydrochloric acid

C dilute hydrochloric acid

D dilute sodium chloride solution

10 Aluminium is extracted by electrolysis as shown.



Which row shows the ionic half-equations at the cathode and the anode?

	cathode	anode
A	$Al^{3+} \rightarrow Al + 3e^-$	$2O^{2-} \rightarrow O_2 + 4e^-$
B	$Al^{3+} \rightarrow Al + 3e^-$	$2O^{2-} + 4e^- \rightarrow O_2$
C	$Al^{3+} + 3e^- \rightarrow Al$	$2O^{2-} \rightarrow O_2 + 4e^-$
D	$Al^{3+} + 3e^- \rightarrow Al$	$2O^{2-} + 4e^- \rightarrow O_2$

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11 Fuel cells are used as energy sources in cars.

Which row gives a fuel used in a fuel cell and the products formed?

	fuel in a fuel cell	products formed
A	hydrogen	carbon dioxide and water
B	hydrogen	water only
C	petrol	carbon dioxide and water
D	petrol	water only

12 Two elements, X and Y, react together to form a covalent molecule as shown.

The reaction is exothermic.

$$X_2(g) + Y_2(g) \rightarrow 2XY(g)$$

The bond energies are shown in the table.

bond	bond energy in kJ / mol
X–X	436
Y–Y	242
X–Y	431

What is the energy change for the reaction?

A +184 kJ / mol **B** –184 kJ / mol **C** +247 kJ / mol **D** –247 kJ / mol

13 Which change in reaction conditions increases both the collision rate and the proportion of molecules with sufficient energy to react?

A addition of a catalyst

B increasing the concentration of a reactant

C increasing the surface area of a reactant

D increasing the temperature of the reaction

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14 When blue-green crystals of nickel(II) sulfate are heated, water is produced and a yellow solid remains. When water is added to the yellow solid, the blue-green colour returns.

Which process describes these changes?

A combustion

B corrosion

C neutralisation

D reversible reaction

15 The equation for the manufacture of ethanol is shown.

$$\underset{\text{ethene}}{C_2H_4(g)} + \underset{\text{steam}}{H_2O(g)} \rightleftharpoons \underset{\text{ethanol}}{C_2H_5OH(g)}$$

What is the effect of doubling the pressure on this reaction?

A decreases the rate of formation of ethanol

B increases the yield of ethene

C decreases the rate of formation of ethene

D increases the yield of ethanol

16 The ionic equation for the reaction of aqueous potassium bromide with chlorine gas is shown.

$$2Br^- + Cl_2 \rightarrow Br_2 + 2Cl^-$$

Which statement is correct?

A Bromide ions are oxidised by gaining electrons.

B Bromide ions are oxidised by losing electrons.

C Chlorine is oxidised by gaining electrons.

D Chlorine is oxidised by losing electrons.

17 Which type of oxide are carbon monoxide and aluminium oxide?

	carbon monoxide	aluminium oxide
A	acidic	amphoteric
B	acidic	basic
C	neutral	amphoteric
D	neutral	basic

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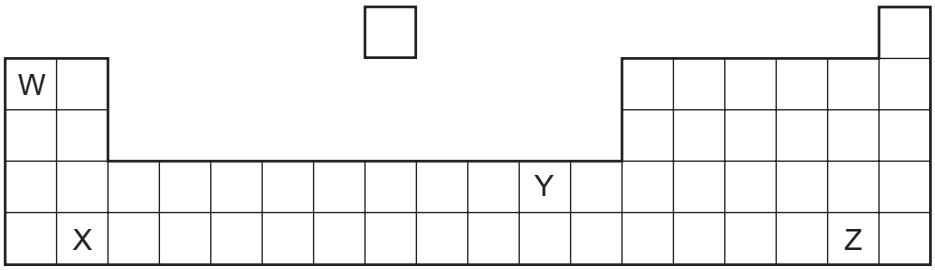
18 The positions of elements W, X, Y and Z in the Periodic Table are shown.



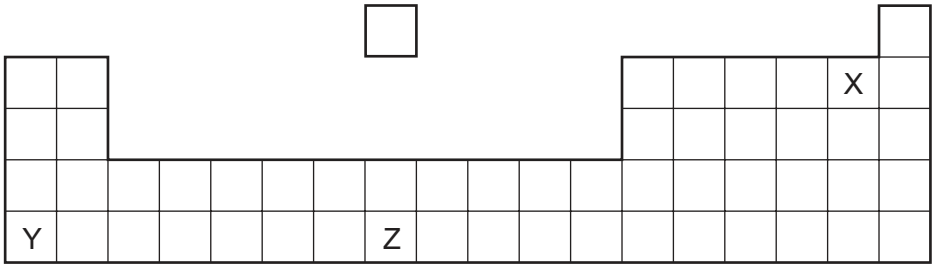
Which elements form basic oxides?

A W, X and Y **B** W and X only **C** Y only **D** Z only

19 Which row shows the difference between a weak acid and a strong acid?

	weak acid	strong acid
A	fully ionised	partially ionised
B	concentrated	dilute
C	dilute	concentrated
D	partially ionised	fully ionised

20 Part of the Periodic Table is shown.



Which row describes the properties of X, Y and Z?

	good conductor of electricity	high melting point
A	X	Z
B	Y	Z and X
C	Y and Z	Z
D	Z and X	X

21 The melting points and boiling points of the elements of Group I of the Periodic Table are shown.

element	melting point / °C	boiling point / °C
lithium	181	1330
sodium	98	883
potassium	63	759
rubidium	39	688
caesium	28	671

Which pair of elements are liquid at 800 °C?

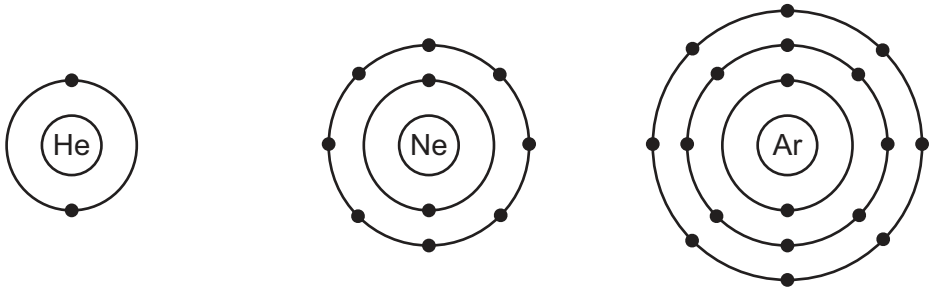
A caesium and rubidium

B potassium and sodium

C lithium and sodium

D potassium and caesium

22 The electronic structures of helium, neon and argon are shown.



Which row describes these gases?

	reactivity	form of the gas	electronic structure
A	reactive	monoatomic	incomplete outer shell of electrons
B	unreactive	diatomic	complete outer shell of electrons
C	unreactive	diatomic	incomplete outer shell of electrons
D	unreactive	monoatomic	complete outer shell of electrons

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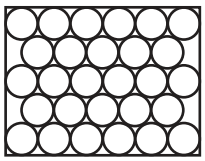
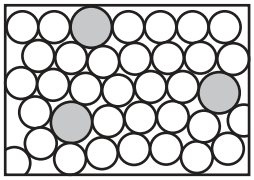
[Turn over

23 The diagrams show the structure of two substances used to make electrical conductors.

X



Y



Which statement correctly describes X and Y?

A X is a pure metal and Y is a compound.

B X is a pure metal and Y is an alloy.

C X is a solid and Y is a liquid.

D X is harder and stronger than Y.

24 A student heated the carbonates and nitrates of sodium and copper.

The results are shown.

	compound heated	gases released	solid formed
1	sodium carbonate	carbon monoxide	sodium oxide
2	copper(II) carbonate	carbon dioxide	copper
3	sodium nitrate	oxygen only	sodium nitrite
4	copper(II) nitrate	nitrogen dioxide and oxygen	copper(II) oxide

Which rows describe the correct results?

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

25 Zinc is extracted from its ore, zinc blende, using two chemical reactions.

1 $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

2 $2ZnO + C \rightarrow 2Zn + CO_2$

Which substance is reduced in reactions 1 and 2?

	reaction 1	reaction 2
A	O_2	C
B	O_2	ZnO
C	ZnS	C
D	ZnS	ZnO

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26 Four metals, zinc, M, copper and magnesium, are reacted with aqueous solutions of their nitrates.

The results are shown.

metal	magnesium nitrate	M nitrate	copper nitrate	zinc nitrate
magnesium		✓	✓	✓
zinc	✗	✓	✓	
M	✗		✓	✗
copper	✗	✗		✗

key

✓ = reacts

✗ = no reaction

What is the order of reactivity of these four metals starting with the most reactive?

A copper → zinc → M → magnesium

B copper → M → zinc → magnesium

C magnesium → M → zinc → copper

D magnesium → zinc → M → copper

27 Which property of aluminium makes it useful in the manufacture of aircraft?

A conducts electricity

B high boiling point

C low density

D silver colour

28 The exhaust gases from cars contain oxides of nitrogen.

How are these oxides of nitrogen formed?

A Nitrogen and oxygen from the air react together at the high temperatures in the engine.

B Nitrogen and oxygen from the petrol react together in the car exhaust.

C Nitrogen from the petrol reacts with oxygen at the high temperatures in the engine.

D Nitrogen reacts with oxygen from the air in the catalytic converter.

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[Turn over

29 Water can be treated by filtration then chlorination.

Which uses do **not** need water of this quality?

1 water for cooling in industry

2 water for washing clothes

3 water for drinking

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

30 Some of the processes involved in the carbon cycle are shown.

1 glucose + oxygen → carbon dioxide + water

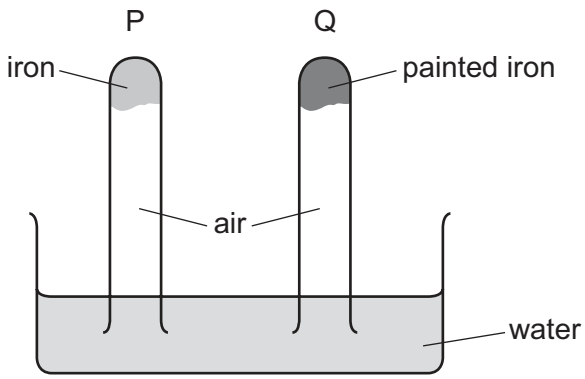
2 carbon dioxide + water → glucose + oxygen

3 methane + oxygen → carbon dioxide + water

What are the names of these processes?

	1	2	3
A	combustion	respiration	photosynthesis
B	photosynthesis	combustion	respiration
C	respiration	combustion	photosynthesis
D	respiration	photosynthesis	combustion

31 The diagram shows an experiment to investigate how paint affects the rusting of iron.



What happens to the water level in tubes P and Q?

	tube P	tube Q
A	falls	rises
B	no change	rises
C	rises	falls
D	rises	no change

32 Ammonia is produced in the Haber process.

The equation for the reaction is shown.

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

The forward reaction is exothermic.

Which conditions of temperature and pressure produce the highest yield of ammonia?

	temperature	pressure
A	high	high
B	high	low
C	low	high
D	low	low

33 Which row shows the conditions used in the Contact process?

	temperature / °C	pressure / atm	catalyst
A	25	2	iron
B	25	200	iron
C	450	2	vanadium(V) oxide
D	450	200	vanadium(V) oxide

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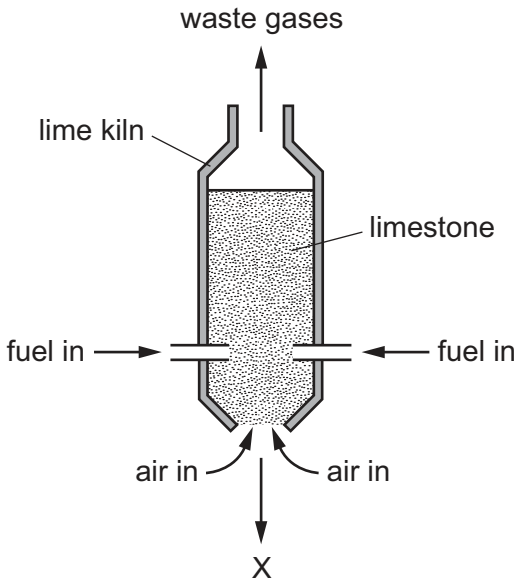
[Turn over

34 The diagram represents a lime kiln used to heat limestone to a very high temperature.



What leaves the kiln at X?

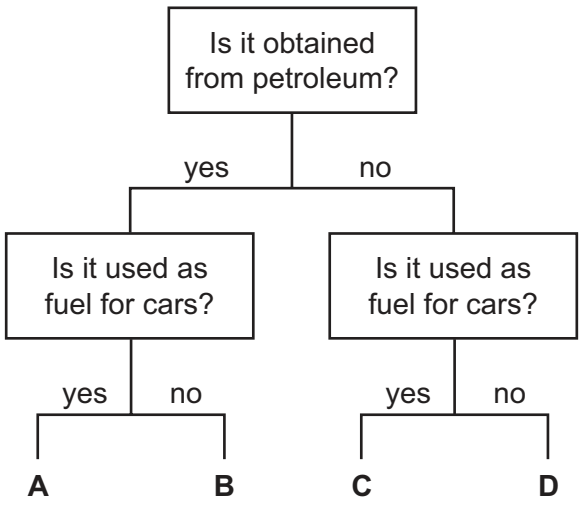
A calcium carbonate

B calcium hydroxide

C calcium oxide

D calcium sulfate

35 Which fuel could be gasoline?



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36 Which statement about homologous series is **not** correct?

A All homologous series are hydrocarbons.

B Members of a homologous series have the same functional group.

C Members of a homologous series have similar chemical properties.

D The alkanes are an example of a homologous series.

37 In bright sunlight, ethane and chlorine combine in substitution reactions.

Which compound is **not** formed in these reactions?

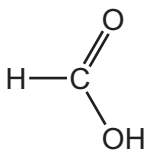
A C_2H_3Cl **B** C_2H_5Cl **C** $C_2H_4Cl_2$ **D** HCl

38 What are the properties of aqueous ethanoic acid?

	decolourises bromine water	reacts with calcium carbonate to make carbon dioxide	turns damp red litmus blue
A	✓	✓	✗
B	✓	✗	✓
C	✗	✓	✗
D	✗	✗	✓

39 The structures of four molecules are shown.

1



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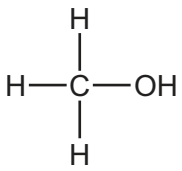

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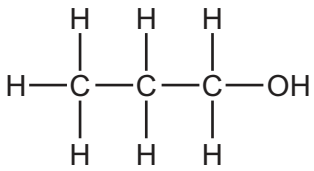

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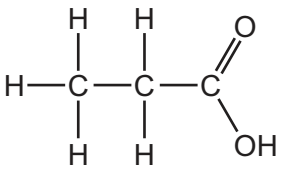


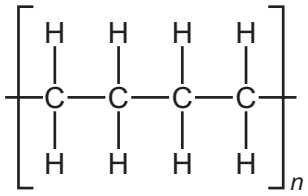
Which molecules react together to form the ester propyl methanoate?

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

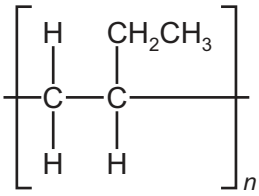
40 But-1-ene has the structure $CH_3CH_2CH=CH_2$.

What is the structure of poly(but-1-ene)?

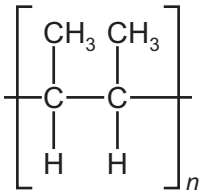
A



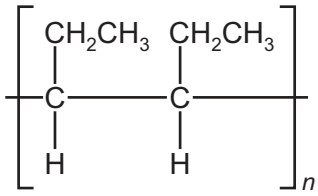
B



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.).