Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **October/November 2016**

45 minutes

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

* 3 3 0 3 8 9 2 0 4 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 20.
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 **17** printed pages and **3** blank pages.

© UCLES 2016

1 ‘Particles moving **very slowly** from an area of higher concentration to an area of lower concentration.’

Which process is being described?

A a liquid being frozen

B a solid melting

C a substance diffusing through a liquid

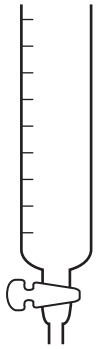
D a substance diffusing through the air

2 A student mixes 25 cm^3 samples of dilute hydrochloric acid with different volumes of aqueous sodium hydroxide.

In each case, the student measures the change in temperature to test if the reaction is exothermic.

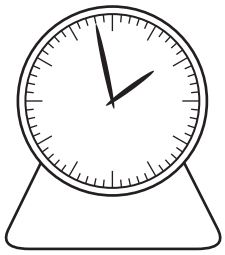
Which piece of apparatus is **not** needed?

A



burette

B



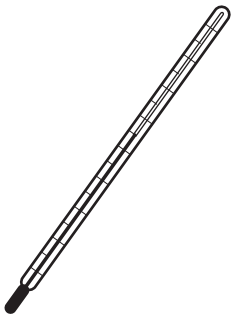
clock

C



pipette

D



thermometer

3 A sample contains a mixture of powdered limestone (calcium carbonate), sugar and wax.

What is the correct way to obtain a pure sample of sugar?

A Dissolve the mixture in dilute hydrochloric acid, filter and wash the residue.

B Dissolve the mixture in hexane, filter and evaporate the filtrate.

C Dissolve the mixture in water, filter and evaporate the filtrate.

D Dissolve the mixture in water, filter and wash the residue.

© UCLES 2016

4 The table shows information about four different particles.

particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
Na	11	23	11	W	11
Na^+	11	23	11	12	X
O	8	16	8	Y	8
O^{2-}	8	16	8	8	Z

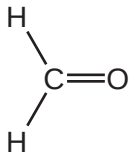
What are the values of W, X, Y and Z?

	W	X	Y	Z
A	11	10	10	8
B	11	11	8	10
C	12	10	8	10
D	12	11	10	8

5 In which ionic compound do the metal ion and the non-metal ion have the same electronic structure?

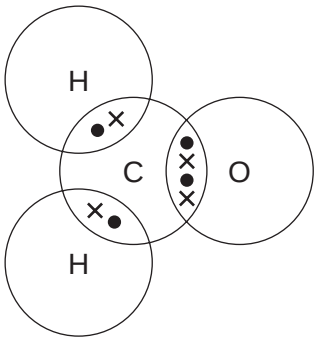
A CaO **B** KBr **C** MgO **D** NaC*l*

6 The structure of methanal is shown.

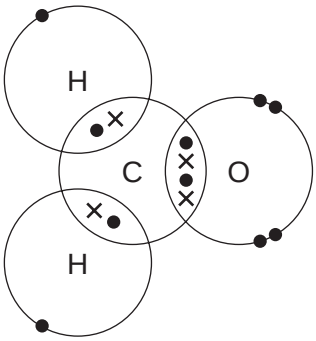


Which diagram shows the arrangement of outer shell electrons in a molecule of methanal?

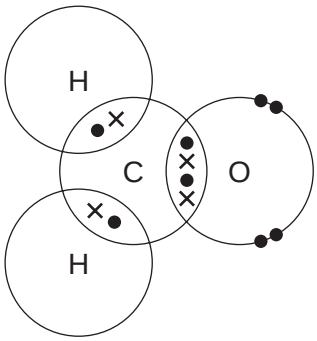
A



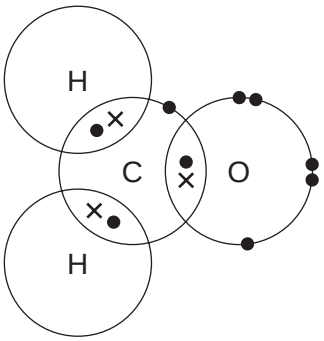
B



C



D



7 Iron is a metal. Its structure consists of a giant lattice of positive ions in a ‘sea of electrons’.

Which statements about solid iron are correct?

1 Iron conducts electricity because the electrons are free to move.

2 Iron conducts heat because the positive ions are free to move.

3 Iron has a high melting point due to the strong covalent bonds.

4 Iron is malleable because the layers of ions can slide over one another.

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

© UCLES 2016

8 Which sample contains the greatest number of molecules?

A 4 g of hydrogen

B 18 g of water

C 24 dm^3 of oxygen

D 66 g of carbon dioxide

9 Sodium carbonate solution reacts with dilute hydrochloric acid. The equation for the reaction is shown.

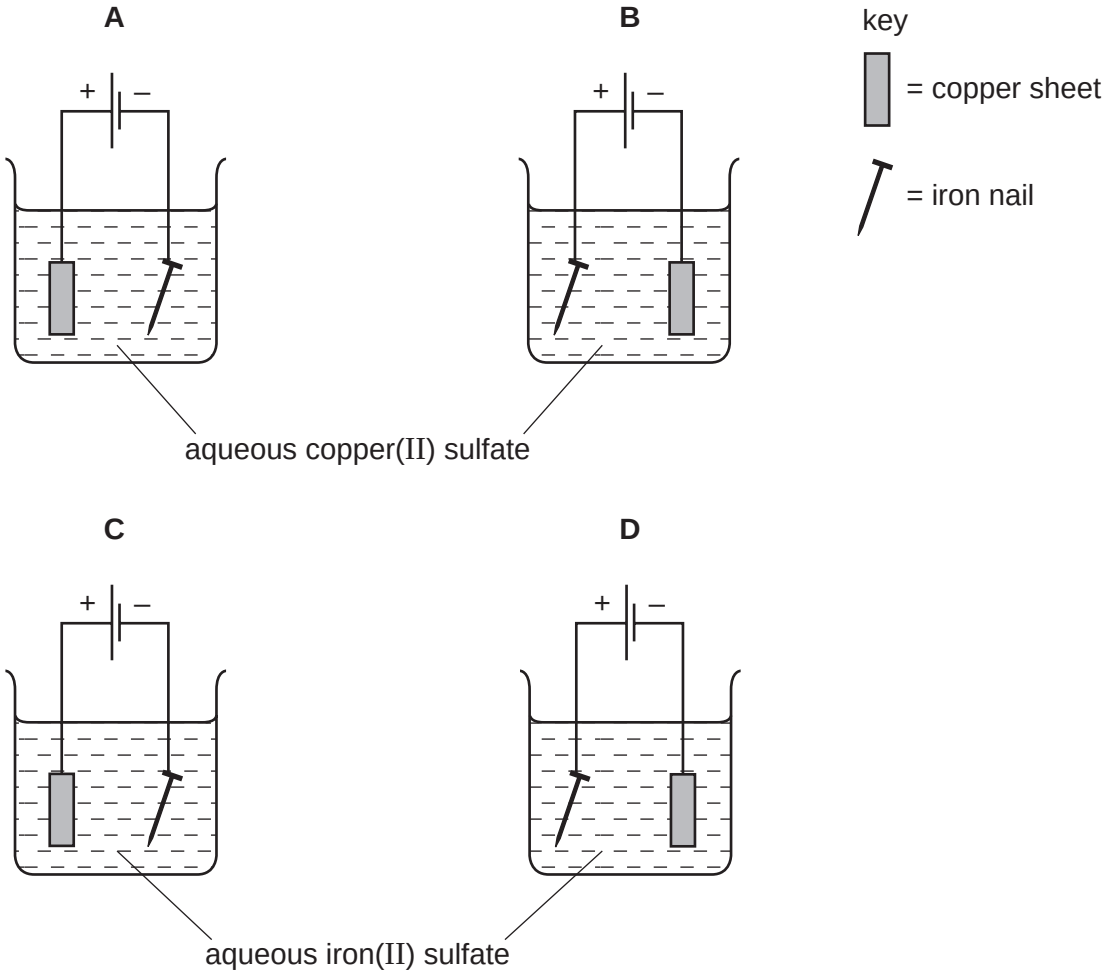
$$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$$

Excess sodium carbonate is added to 10.0 cm^3 of 0.10 mol / dm^3 hydrochloric acid.

Which volume of carbon dioxide gas is made?

A 12 cm^3 **B** 24 cm^3 **C** 12 000 cm^3 **D** 24 000 cm^3

10 Which apparatus could be used to electroplate an iron nail with copper?



11 A student sets up a number of simple cells by putting strips of two different metals into dilute sulfuric acid.

Which cell produces the highest voltage?

A copper and magnesium

B copper and zinc

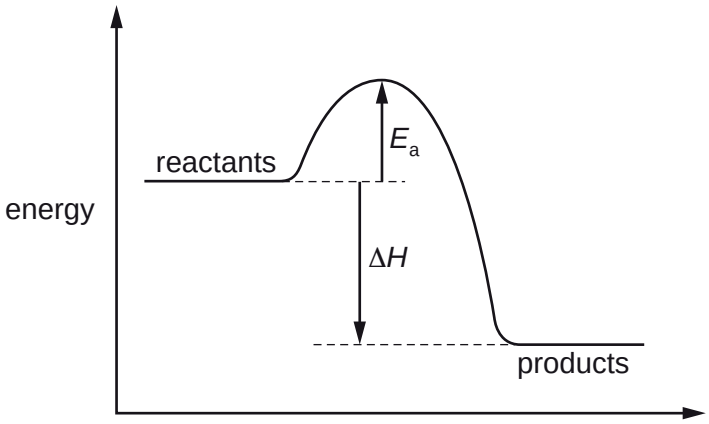
C iron and copper

D magnesium and zinc

12 Which experiment is the most exothermic?

	initial temperature / °C	final temperature / °C
A	20	5
B	20	32
C	25	12
D	25	34

13 The energy level diagram for a reaction is shown.



Which row is correct?

	sign of ΔH	overall energy change	sign of E_a
A	–	exothermic	–
B	+	endothermic	+
C	+	endothermic	–
D	–	exothermic	+

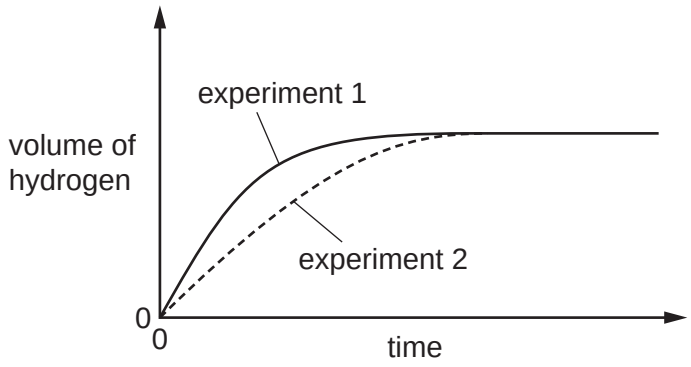
© UCLES 2016

14 Zinc granules are reacted with excess dilute hydrochloric acid.

The volume of hydrogen given off is measured at different times.

The results are shown on the graph, labelled experiment 1.

The results for a second experiment are also shown on the graph, labelled experiment 2.



Which change to the conditions was made in experiment 2?

A The concentration of the hydrochloric acid was decreased.

B The size of the zinc granules was decreased.

C The surface area of the zinc granules was increased.

D The temperature was increased.

15 In an experiment nitric acid is added to excess marble chips and the volume of carbon dioxide formed is measured.

The experiment is repeated using smaller marble chips. All other conditions remain the same.

Which statement about the second experiment is correct?

A The collisions are more frequent and higher energy.

B The collisions are more frequent and the same energy.

C The collisions are the same frequency and the same energy.

D The collisions are the same frequency and higher energy.

© UCLES 2016

16 At 400 °C the reaction between hydrogen and iodine reaches an equilibrium. The reaction is exothermic.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g) \qquad \Delta H = -13\,kJ/mol$$

Which change in conditions would increase the percentage of hydrogen iodide in the equilibrium mixture?

A a decrease in pressure

B a decrease in temperature

C an increase in pressure

D an increase in temperature

17 Chromium forms the compound chromium(III) sulfate.

What does the (III) represent?

A the charge on a sulfate ion

B the number of chromium ions combined with one sulfate ion

C the number of sulfate ions combined with one chromium ion

D the oxidation state of chromium

18 Germanium oxide is a white powder.

Germanium oxide reacts with concentrated hydrochloric acid.

Germanium oxide reacts with concentrated aqueous sodium hydroxide.

Germanium oxide does not dissolve when added to water.

Which type of oxide is germanium oxide?

A acidic

B amphoteric

C basic

D neutral

© UCLES 2016

19 Hydrogen chloride gas reacts with water to produce an acidic solution. The equation for the reaction is shown.

$$HCl + H_2O \rightarrow Cl^- + H_3O^+$$

Which statement describes what happens during the reaction?

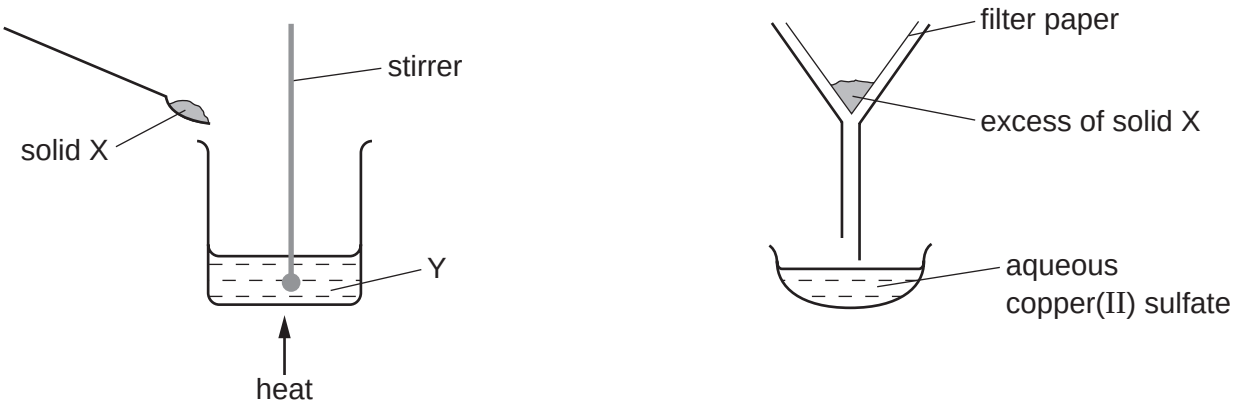
A The chloride ion is formed by accepting an electron from the water.

B The hydrogen chloride loses an electron to form the chloride ion.

C The water accepts a proton from the hydrogen chloride.

D The water donates a proton to the hydrogen chloride.

20 The apparatus shown is used to prepare aqueous copper(II) sulfate.



What are X and Y?

	X	Y
A	copper	aqueous iron(II) sulfate
B	copper(II) chloride	sulfuric acid
C	copper(II) oxide	sulfuric acid
D	sulfur	aqueous copper(II) chloride

21 Information about some silver compounds is shown in the table.

compound	formula	solubility in water
silver carbonate	Ag_2CO_3	insoluble
silver chloride	AgCl	insoluble
silver nitrate	$AgNO_3$	soluble
silver oxide	Ag_2O	insoluble

Which equation shows a reaction which **cannot** be used to make a silver salt?

A $AgNO_3(aq) + HCl(aq) \rightarrow AgCl(s) + HNO_3(aq)$

B $Ag_2O(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l)$

C $Ag_2CO_3(s) + 2HNO_3(aq) \rightarrow 2AgNO_3(aq) + H_2O(l) + CO_2(g)$

D $2Ag(s) + 2HCl(aq) \rightarrow 2AgCl(s) + H_2(g)$

22 What is **not** a property of Group I metals?

A They are soft and can be cut with a knife.

B They react when exposed to oxygen in the air.

C They produce an acidic solution when they react with water.

D They react rapidly with water producing hydrogen gas.

© UCLES 2016

23 Aqueous sodium hydroxide was added slowly, until in excess, to separate solutions of W, X, Y and Z.

The results are shown.

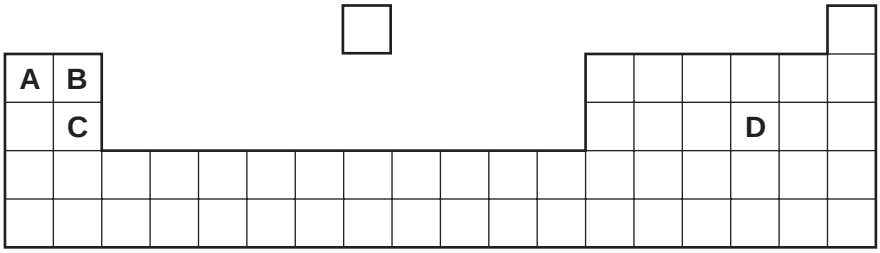
solution	initial observation with aqueous sodium hydroxide	final observation with excess aqueous sodium hydroxide
W	white precipitate formed	precipitate dissolves
X	white precipitate formed	no change
Y	pale blue precipitate formed	no change
Z	green precipitate formed	no change

Which row identifies the metal ions in the solutions?

	metal ion in solution W	metal ion in solution X	metal ion in solution Y	metal ion in solution Z
A	aluminium	calcium	copper(II)	iron(II)
B	aluminium	calcium	iron(II)	copper(II)
C	aluminium	iron(II)	calcium	copper(II)
D	calcium	aluminium	copper(II)	iron(II)

24 Part of the Periodic Table is shown.

Which element has two electrons in its outer shell and three electron shells?



25 Impurities in iron obtained from the blast furnace include carbon, phosphorus and silicon.

Which impurities are removed from the molten iron as gases when it is made into steel?

A carbon and phosphorus

B carbon and silicon

C carbon only

D phosphorus and silicon

26 Y displaces X from its aqueous sulfate.

X does not displace W from its aqueous sulfate.

X displaces Z from its aqueous sulfate.

What is the order of reactivity of elements W, X, Y and Z?

	most reactive →			least reactive
A	W	X	Y	Z
B	W	Y	X	Z
C	Z	X	Y	W
D	Z	W	Y	X

27 Which statement about the industrial extraction of aluminium from aluminium oxide is correct?

A Aluminium is extracted by heating its oxide with carbon.

B Aluminium is extracted using electrolysis and is collected at the anode.

C Aluminium is extracted using platinum electrodes and direct current.

D Molten cryolite is used as a solvent for aluminium oxide.

28 The alloy brass is a mixture of copper and another metal.

Brass is used to make the pins of electrical plugs.

Copper is used to make electrical wiring.

Which row about brass is correct?

	hardness	electrical conductivity	other metal
A	harder than copper	better than copper	tin
B	harder than copper	worse than copper	zinc
C	softer than copper	better than copper	tin
D	softer than copper	worse than copper	zinc

© UCLES 2016

29 Air is a mixture of gases.

Which gas is present in the largest amount?

A argon

B carbon dioxide

C nitrogen

D oxygen

30 Which information about carbon dioxide and methane is correct?

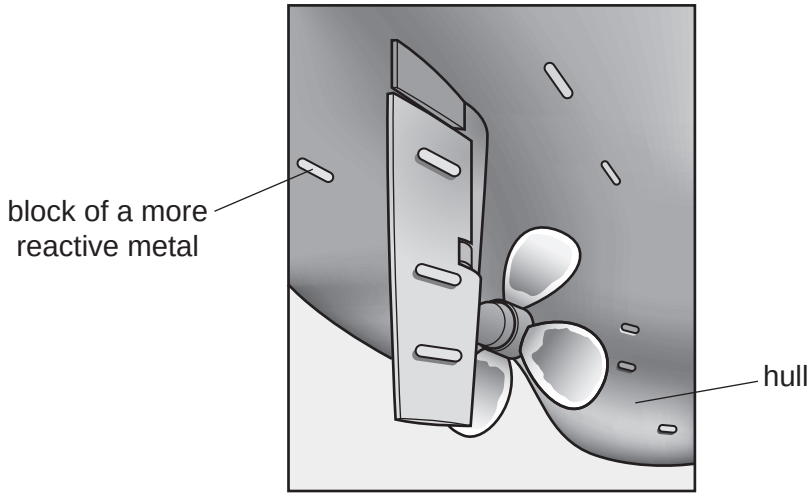
		carbon dioxide	methane
A	formed when vegetation decomposes	✓	✗
B	greenhouse gas	✓	✓
C	present in unpolluted air	✗	✗
D	produced during respiration	✗	✓

key

✓ = true

✗ = false

31 Boats made from steel can be protected from rusting by attaching blocks of a more reactive metal to the hull of the boat.



Which statement is correct?

A Copper is used for the blocks because it does not react with water.

B Magnesium is not used for the blocks because it reacts with steel.

C The metal used for the blocks loses electrons more easily than steel.

D This form of protection from rusting is called galvanising.

32 Ammonia is manufactured by the Haber process, using an iron catalyst.

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

It is not possible to obtain 100% yield.

What is the reason for this?

A A high pressure is used.

B Ammonia decomposes at high temperature.

C Some of the ammonia is recycled.

D The ammonia reacts with the catalyst.

33 Sulfuric acid is manufactured by a series of chemical reactions, one of which is catalysed by vanadium(V) oxide.

What is the equation for the reaction catalysed by vanadium(V) oxide?

A $S + O_2 \rightarrow SO_2$

B $2S + 3O_2 \rightarrow 2SO_3$

C $2SO_2 + O_2 \rightarrow 2SO_3$

D $SO_3 + H_2O \rightarrow H_2SO_4$

34 Which substance gives off carbon dioxide on heating?

A lime

B limestone

C limewater

D slaked lime

35 Petroleum is separated into fractions.

Which statement is **not** correct?

A Each fraction contains a mixture of hydrocarbon molecules.

B Fuel oil burns easily and is used as fuel in cars.

C Refinery gas is the fraction containing the smallest molecules.

D The fractions are separated depending on their boiling point range.

© UCLES 2016

36 Butane reacts as shown.

$$\text{butane} \xrightarrow[\text{and heat}]{\text{catalyst}} \text{butene} + \text{hydrogen}$$

What is this type of reaction?

A combustion

B cracking

C polymerisation

D reduction

37 Substance Z has the following characteristics.

1 It burns in an excess of oxygen to form carbon dioxide and water.

2 It is oxidised by air to form a liquid smelling of vinegar.

3 It reacts with carboxylic acids to form esters.

What is substance Z?

A ethane

B ethanoic acid

C ethanol

D ethyl ethanoate

38 Ethanol is manufactured by the catalytic addition of steam to ethene and by fermentation.

Which row shows an advantage and a disadvantage of using the catalytic addition of steam to ethene compared to fermentation?

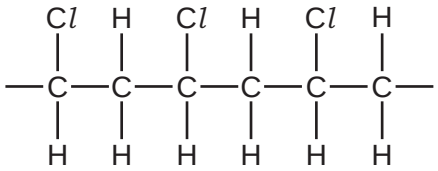
	advantage	disadvantage
A	fast	the product is impure
B	fast	uses non-renewable materials
C	the product is pure	slow
D	uses renewable materials	slow

© UCLES 2016

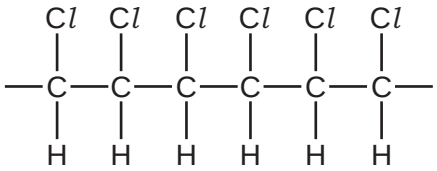
39 Chloroethene, CH_2=CHC*l*, can be polymerised.

Which diagram represents a section of the polymer?

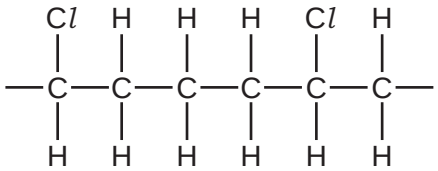
A



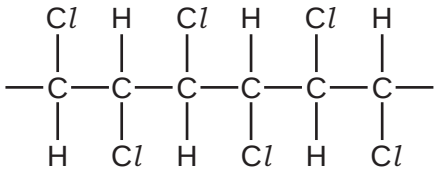
B



C



D



40 *Terylene* is a synthetic polymer.

Which statement about *Terylene* is **not** correct?

A It contains amide linkages.

B It contains carbon and oxygen atoms.

C It is made from small units called monomers.

D It is formed by condensation polymerisation.

© UCLES 2016

BLANK PAGE

BLANK PAGE

BLANK PAGE

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge International Examinations Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at www.cie.org.uk after the live examination series.

Cambridge International Examinations is part of the Cambridge Assessment Group. Cambridge Assessment is the brand name of University of Cambridge Local Examinations Syndicate (UCLES), which is itself a department of the University of Cambridge.

© UCLES 2016

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.)