



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY

0620/13

Paper 1 Multiple Choice (Core)

October/November 2016

45 minutes

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

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.



- 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 25cm^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.

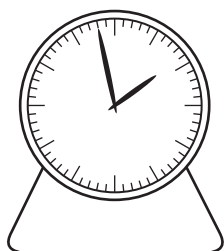
Which piece of apparatus is **not** needed?

A



burette

B



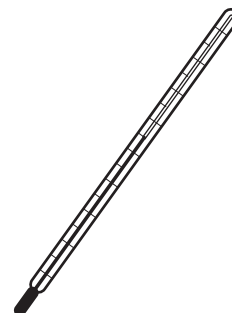
clock

C



pipette

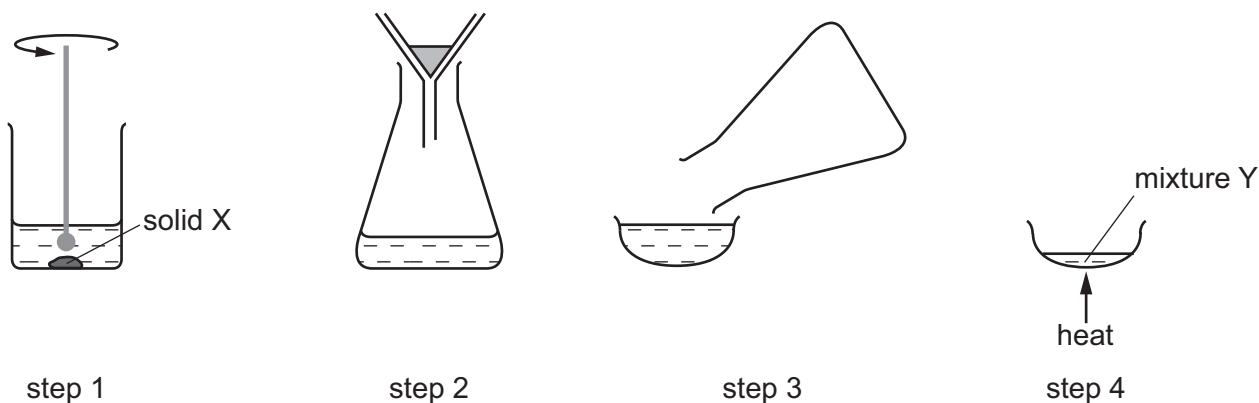
D



thermometer

- 3 A solid X is purified in five steps.

The first four steps of the purification are shown in the diagram.



In **step 5**, how is a pure sample of solid X obtained from mixture Y?

- A dissolving
 - B distillation
 - C evaporating
 - D filtering
- 4 An atom has three electron shells. There are three electrons in the outer shell.

How many protons and how many neutrons are in this atom?

	protons	neutrons
A	13	14
B	13	27
C	14	13
D	21	24

- 5 Boron nitride is a compound of the elements boron and nitrogen.

It has a similar structure to diamond.

What is likely to be a property of boron nitride?

- A It conducts electricity.
- B It is soluble in water.
- C It is used as a lubricant.
- D It is very hard.

6 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

7 Which elements are in the compound BaCO_3 ?

- A** barium and cobalt
- B** boron, actinium and oxygen
- C** carbon, oxygen and barium
- D** oxygen, calcium and boron

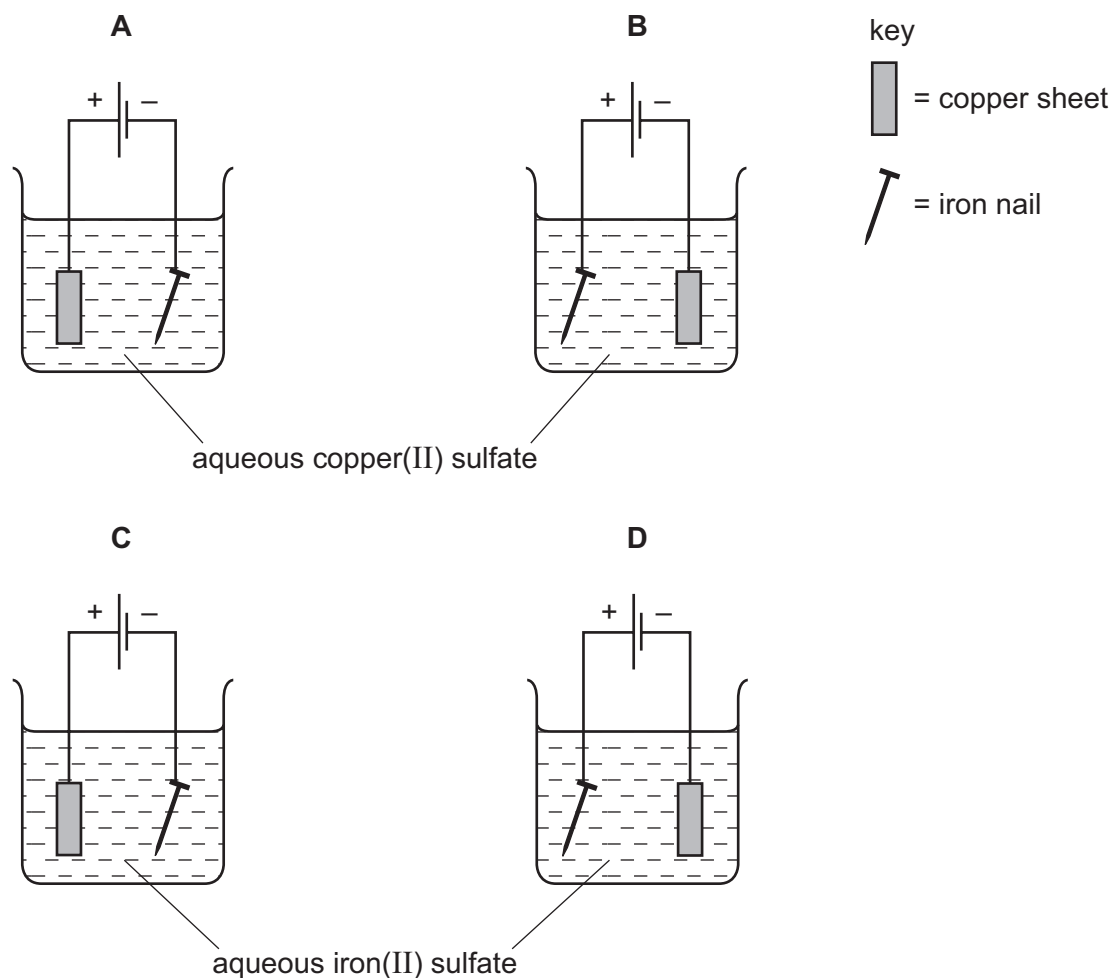
8 Concentrated aqueous sodium iodide is electrolysed using platinum electrodes.

The solution contains the ions Na^+ , I^- , H^+ and OH^- .

Which electrodes are the ions attracted to during this electrolysis?

	cathode	anode
A	H^+ and Na^+	I^- and OH^-
B	H^+ and OH^-	I^- and Na^+
C	I^- and Na^+	H^+ and OH^-
D	I^- and OH^-	H^+ and Na^+

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



10 10g of ammonium nitrate are added to water at 25°C and the mixture stirred. The ammonium nitrate dissolves and, after one minute, the temperature of the solution is 10°C.

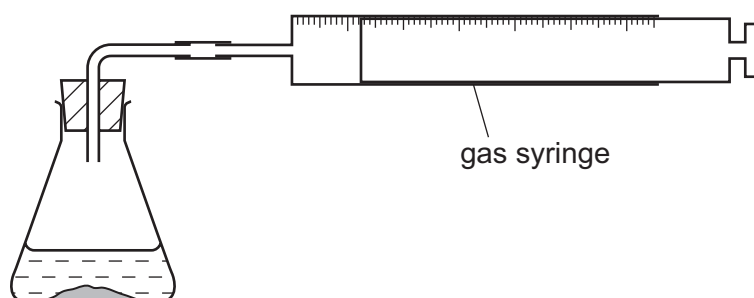
Which word describes this change?

- A endothermic
- B exothermic
- C neutralisation
- D reduction

11 What is **always** produced when a fuel is burnt?

- A carbon dioxide
- B carbon monoxide
- C heat energy
- D oxides of nitrogen

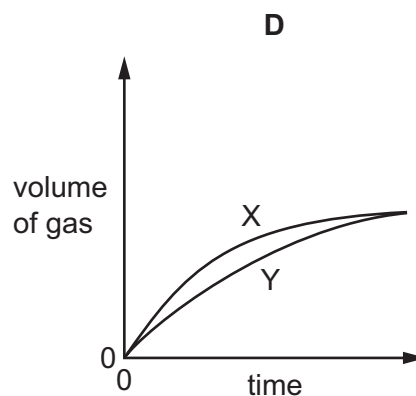
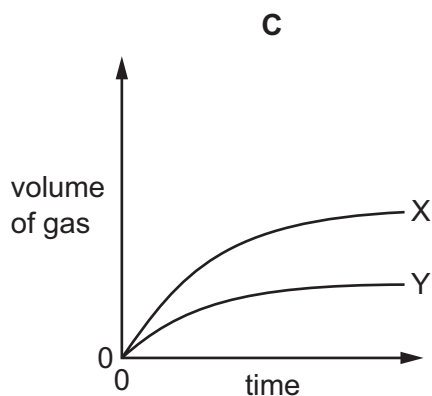
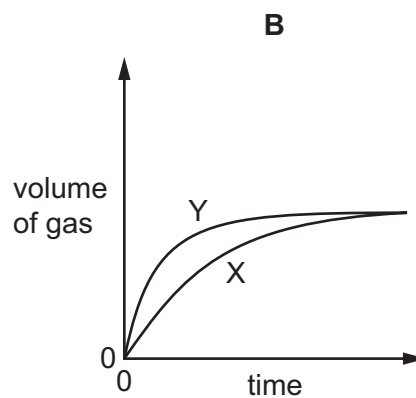
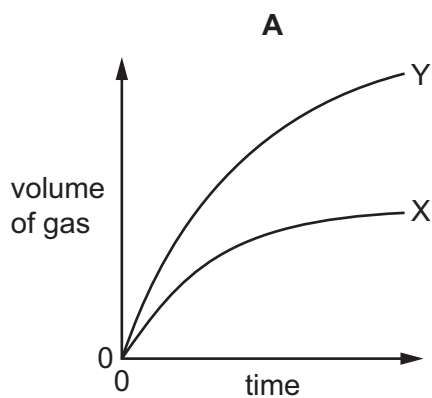
12 An experiment X is carried out between a solid and a solution using the apparatus shown.



The volume of gas given off is measured at different times and the results plotted on a graph.

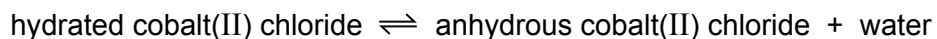
In a second experiment Y, the surface area of the solid is increased but all other factors remain the same.

Which graph shows the results of experiments X and Y?



- 13 Hydrated cobalt(II) chloride crystals are pink.

When they are heated, they lose water and form blue anhydrous cobalt(II) chloride.



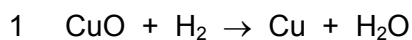
A few drops of vinegar were added to anhydrous cobalt(II) chloride.

There was a colour change from blue to pink.

What does this colour change show about vinegar?

- A It contains an acid.
- B It contains water.
- C It is an alkali.
- D It is anhydrous.

- 14 The equations for three reactions are shown.



Which statement about the reactions is **not** correct?

- A In reaction 1, copper(II) oxide is reduced to copper.
- B In reaction 2, carbon monoxide is oxidised to carbon dioxide.
- C In reactions 1 and 3, hydrogen is oxidised to water.
- D In reaction 2, iron(III) oxide is oxidised to iron.

15 Part of the Periodic Table is shown.

The diagram shows a periodic table grid with the following structure:

- Period 1:** 2 cells.
- Period 2:** 8 cells.
- Period 3:** 8 cells.
- Period 4:** 18 cells.
- Period 5:** 18 cells.
- Period 6:** 32 cells.
- Period 7:** 24 cells.

Element **X** is located in the 3rd row, 1st column (Lithium). Element **Y** is located in the 3rd row, 17th column (Chlorine).

Which type of oxides do X and Y form?

	X	Y
A	acidic	acidic
B	acidic	basic
C	basic	acidic
D	basic	basic

16 Compound T is added to dilute hydrochloric acid and warmed gently.

The mixture gives off a gas which turns acidified aqueous potassium manganate(VII) from purple to colourless.

A flame test on compound T gives a lilac flame.

What is compound T?

- A** sodium sulfate
B sodium sulfite
C potassium sulfate
D potassium sulfite

17 Acids can react with metal oxides, carbonates and metals.

Which reactions produce a gas?

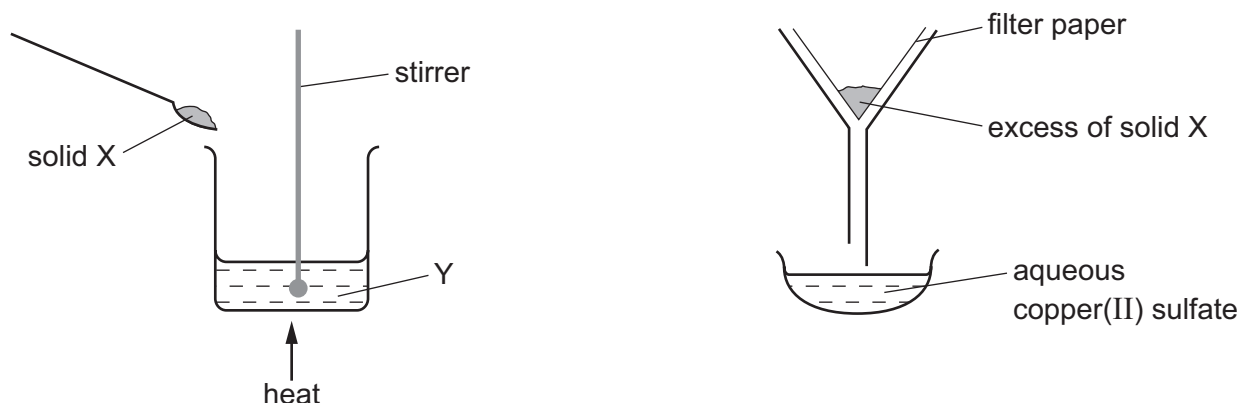
	acid with metal oxide	acid with carbonate	acid with metal
A	✓	✓	✓
B	✓	x	x
C	x	✓	✓
D	x	✓	x

key

✓ = gas is produced

x = no gas is produced

18 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

19 Elements P and Q are in the same period of the Periodic Table.

P is a metal and Q is a non-metal.

Which statement is correct?

- A** P has a greater nucleon number than Q.
- B** P is to the right of Q in the period.
- C** Q has more electron shells than P.
- D** Q has more protons than P.

20 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.

- 21** A flammable gas needs to be removed from a tank at an industrial plant.

For safety reasons, an inert gas is used.

Which gas is suitable?

- A** argon
- B** hydrogen
- C** methane
- D** oxygen

- 22** Which element is a transition element?

	colour of chloride	melting point of element / °C
A	orange	113
B	orange	1535
C	white	113
D	white	1535

- 23** Which statement about the element bromine is correct?

- A** It displaces chlorine from aqueous potassium chloride.
- B** It has a higher density than chlorine.
- C** It is a diatomic metal.
- D** It is a green gas at room temperature.

- 24** Four metals are listed in decreasing order of reactivity.

magnesium

zinc

iron

copper

Titanium reacts with acid and cannot be extracted from its ore by heating with carbon.

Where should titanium be placed in the list?

- A** below copper
- B** between iron and copper
- C** between magnesium and zinc
- D** between zinc and iron

25 Basic oxides and oxygen are used to convert iron into steel.

Which statement is **not** correct?

- A** Carbon is converted into carbon dioxide.
- B** Silicon is converted into silicon(IV) oxide.
- C** The basic oxides react with acidic impurities to form slag.
- D** The oxygen reacts with the iron to produce hematite.

26 A student added dilute hydrochloric acid to four metals and recorded the results.

Some of the results are **not** correct.

	results	
	metal	gas given off
1	copper	yes
2	iron	yes
3	magnesium	no
4	zinc	yes

Which **two** results are correct?

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

27 Some properties of aluminium are listed.

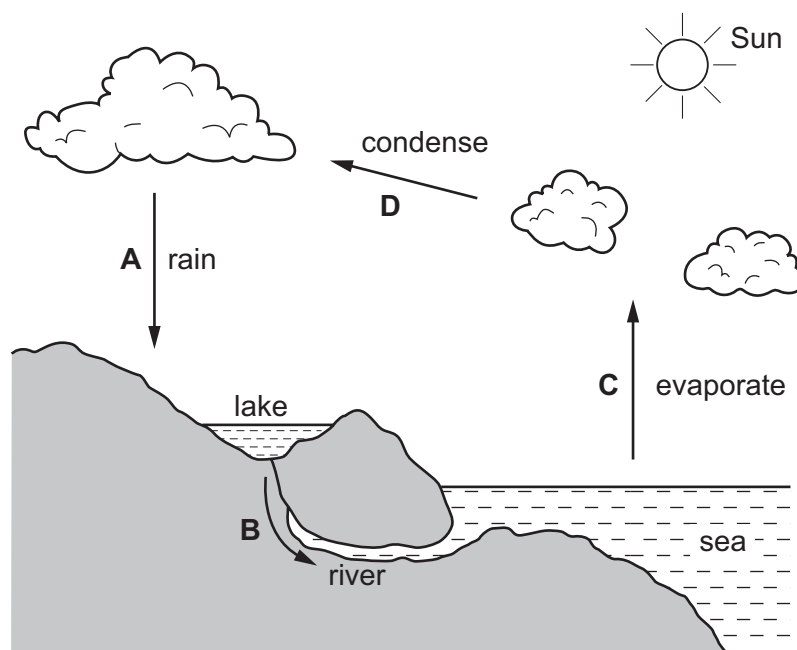
- 1 It conducts heat.
- 2 It has a low density.
- 3 It is mechanically strong.
- 4 It is resistant to corrosion.

Which properties make aluminium suitable for making food containers for chilled food products?

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

28 The diagram represents the water cycle.

At which stage during the cycle are soluble impurities removed from the water?



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	✗	✓

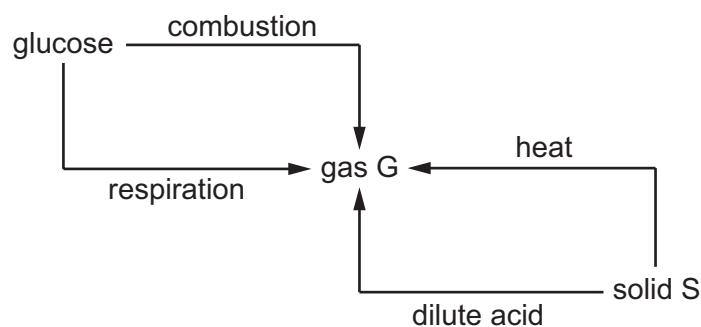
key
 ✓ = true
 ✗ = false

31 Calcium oxide and ammonium salts are used by farmers to treat soils.

Why are these **two** substances added at different times?

- A** They are both acidic.
- B** They are both basic.
- C** They react with each other to produce ammonia.
- D** They react with each other to produce hydrogen.

32 The chart shows how a gas, G, is formed in four reactions, from glucose or from a solid, S.



What are the formulae of gas G and solid S?

	gas G	solid S
A	CH ₄	Ca
B	CH ₄	CaCO ₃
C	CO ₂	Ca
D	CO ₂	CaCO ₃

33 Slaked lime is used to neutralise an acidic soil.

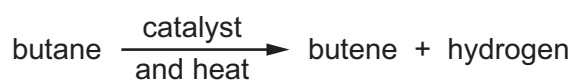
How does the pH of the soil change?

	from	to
A	6	7
B	7	8
C	8	7
D	8	6

34 Which list shows the fractions obtained from distilling petroleum, in order of increasing boiling point?

- A bitumen → diesel oil → fuel oil → lubricating oil
- B diesel oil → gasoline → naphtha → kerosene
- C gasoline → naphtha → kerosene → diesel oil
- D kerosene → lubricating oil → naphtha → refinery gas

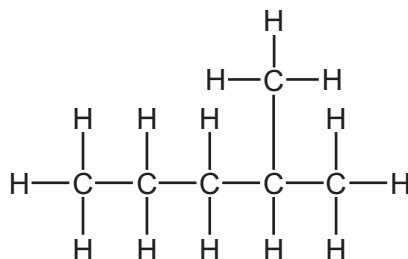
35 Butane reacts as shown.



What is this type of reaction?

- A combustion
- B cracking
- C polymerisation
- D reduction

36 The structure of a compound, X, is shown.



To which homologous series does X belong?

- A alcohols
- B alkanes
- C alkenes
- D carboxylic acids

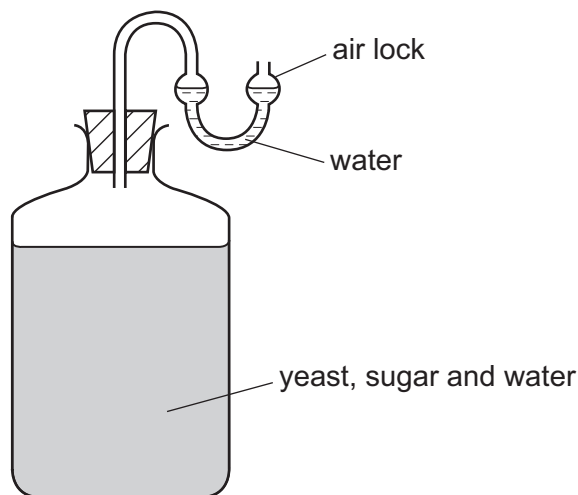
37 An organic compound has the following properties.

colour	effect on Universal Indicator	flammability	effect on aqueous bromine	state at room temperature
colourless	none	highly flammable	decolourises	gas

To which homologous series does this organic compound belong?

- A alcohols
- B alkanes
- C alkenes
- D carboxylic acids

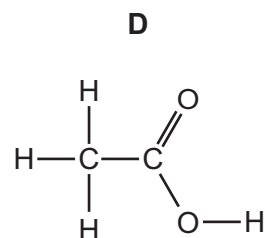
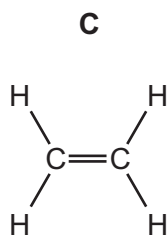
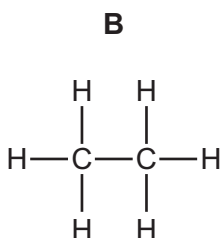
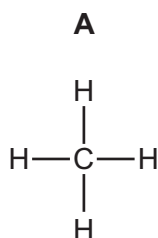
38 The diagram shows some apparatus.



What is made using this apparatus?

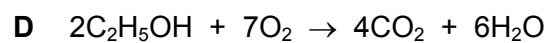
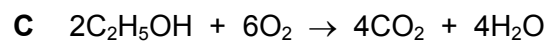
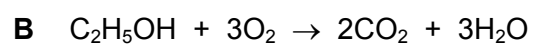
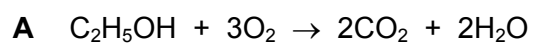
- A ethane
- B ethanoic acid
- C ethanol
- D ethene

39 Which molecule can be polymerised?



40 Ethanol is used as a biofuel.

Which equation shows the complete combustion of ethanol?



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The Periodic Table of Elements

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3 Li lithium 7		4 Be beryllium 9		Key atomic number atomic symbol name relative atomic mass										1 H hydrogen 1							2 He helium 4																																																																																																																																																																																																																																																																																																																																																																																																																									
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 —						117 Ts tennessine —	118 Ug unbinilium —	119 Uut ununilium —	120 Uuq ununquadium —	121 Uub ununbium —	122 Uuh ununhexium —	123 Uus ununseptium —	124 Uuo ununoctium —	125 Uut ununtrium —	126 Uuq ununquadium —	127 Uub ununbium —	128 Uuh ununhexium —	129 Uus ununseptium —	130 Uuo ununoctium —	131 Uut ununtrium —	132 Uuq ununquadium —	133 Uub ununbium —	134 Uuh ununhexium —	135 Uus ununseptium —	136 Uuo ununoctium —	137 Uut ununtrium —	138 Uuq ununquadium —	139 Uub ununbium —	140 Uuh ununhexium —	141 Uus ununseptium —	142 Uuo ununoctium —	143 Uut ununtrium —	144 Uuq ununquadium —	145 Uub ununbium —	146 Uuh ununhexium —	147 Uus ununseptium —	148 Uuo ununoctium —	149 Uut ununtrium —	150 Uuq ununquadium —	151 Uub ununbium —	152 Uuh ununhexium —	153 Uus ununseptium —	154 Uuo ununoctium —	155 Uut ununtrium —	156 Uuq ununquadium —	157 Uub ununbium —	158 Uuh ununhexium —	159 Uus ununseptium —	160 Uuo ununoctium —	161 Uut ununtrium —	162 Uuq ununquadium —	163 Uub ununbium —	164 Uuh ununhexium —	165 Uus ununseptium —	166 Uuo ununoctium —	167 Uut ununtrium —	168 Uuq ununquadium —	169 Uub ununbium —	170 Uuh ununhexium —	171 Uus ununseptium —	172 Uuo ununoctium —	173 Uut ununtrium —	174 Uuq ununquadium —	175 Uub ununbium —	176 Uuh ununhexium —	177 Uus ununseptium —	178 Uuo ununoctium —	179 Uut ununtrium —	180 Uuq ununquadium —	181 Uub ununbium —	182 Uuh ununhexium —	183 Uus ununseptium —	184 Uuo ununoctium —	185 Uut ununtrium —	186 Uuq ununquadium —	187 Uub ununbium —	188 Uuh ununhexium —	189 Uus ununseptium —	190 Uuo ununoctium —	191 Uut ununtrium —	192 Uuq ununquadium —	193 Uub ununbium —	194 Uuh ununhexium —	195 Uus ununseptium —	196 Uuo ununoctium —	197 Uut ununtrium —	198 Uuq ununquadium —	199 Uub ununbium —	200 Uuh ununhexium —	201 Uus ununseptium —	202 Uuo ununoctium —	203 Uut ununtrium —	204 Uuq ununquadium —	205 Uub ununbium —	206 Uuh ununhexium —	207 Uus ununseptium —	208 Uuo ununoctium —	209 Uut ununtrium —	210 Uuq ununquadium —	211 Uub ununbium —	212 Uuh ununhexium —	213 Uus ununseptium —	214 Uuo ununoctium —	215 Uut ununtrium —	216 Uuq ununquadium —	217 Uub ununbium —	218 Uuh ununhexium —	219 Uus ununseptium —	220 Uuo ununoctium —	221 Uut ununtrium —	222 Uuq ununquadium —	223 Uub ununbium —	224 Uuh ununhexium —	225 Uus ununseptium —	226 Uuo ununoctium —	227 Uut ununtrium —	228 Uuq ununquadium —	229 Uub ununbium —	230 Uuh ununhexium —	231 Uus ununseptium —	232 Uuo ununoctium —	233 Uut ununtrium —	234 Uuq ununquadium —	235 Uub ununbium —	236 Uuh ununhexium —	237 Uus ununseptium —	238 Uuo ununoctium —	239 Uut ununtrium —	240 Uuq ununquadium —	241 Uub ununbium —	242 Uuh ununhexium —	243 Uus ununseptium —	244 Uuo ununoctium —	245 Uut ununtrium —	246 Uuq ununquadium —	247 Uub ununbium —	248 Uuh ununhexium —	249 Uus ununseptium —	250 Uuo ununoctium —	251 Uut ununtrium —	252 Uuq ununquadium —	253 Uub ununbium —	254 Uuh ununhexium —	255 Uus ununseptium —	256 Uuo ununoctium —	257 Uut ununtrium —	258 Uuq ununquadium —	259 Uub ununbium —	260 Uuh ununhexium —	261 Uus ununseptium —	262 Uuo ununoctium —	263 Uut ununtrium —	264 Uuq ununquadium —	265 Uub ununbium —	266 Uuh ununhexium —	267 Uus ununseptium —	268 Uuo ununoctium —	269 Uut ununtrium —	270 Uuq ununquadium —	271 Uub ununbium —	272 Uuh ununhexium —	273 Uus ununseptium —	274 Uuo ununoctium —	275 Uut ununtrium —	276 Uuq ununquadium —	277 Uub ununbium —	278 Uuh ununhexium —	279 Uus ununseptium —	280 Uuo ununoctium —	281 Uut ununtrium —	282 Uuq ununquadium —	283 Uub ununbium —	284 Uuh ununhexium —	285 Uus ununseptium —	286 Uuo ununoctium —	287 Uut ununtrium —	288 Uuq ununquadium —	289 Uub ununbium —	290 Uuh ununhexium —	291 Uus ununseptium —	292 Uuo ununoctium —	293 Uut ununtrium —	294 Uuq ununquadium —	295 Uub ununbium —	296 Uuh ununhexium —	297 Uus ununseptium —	298 Uuo ununoctium —	299 Uut ununtrium —	300 Uuq ununquadium —	301 Uub ununbium —	302 Uuh ununhexium —	303 Uus ununseptium —	304 Uuo ununoctium —	305 Uut ununtrium —	306 Uuq ununquadium —	307 Uub ununbium —	308 Uuh ununhexium —	309 Uus ununseptium —	310 Uuo ununoctium —	311 Uut ununtrium —	312 Uuq ununquadium —	313 Uub ununbium —	314 Uuh ununhexium —	315 Uus ununseptium —	316 Uuo ununoctium —	317 Uut ununtrium —	318 Uuq ununquadium —	319 Uub ununbium —	320 Uuh ununhexium —	321 Uus ununseptium —	322 Uuo ununoctium —	323 Uut ununtrium —	324 Uuq ununquadium —	325 Uub ununbium —	326 Uuh ununhexium —	327 Uus ununseptium —	328 Uuo ununoctium —	329 Uut ununtrium —	330 Uuq ununquadium —	331 Uub ununbium —	332 Uuh ununhexium —	333 Uus ununseptium —	334 Uuo ununoctium —	335 Uut ununtrium —	336 Uuq ununquadium —	337 Uub ununbium —	338 Uuh ununhexium —	339 Uus ununseptium —	340 Uuo ununoctium —	341 Uut ununtrium —	342 Uuq ununquadium —	343 Uub ununbium —	344 Uuh ununhexium —	345 Uus ununseptium —	346 Uuo ununoctium —	347 Uut ununtrium —	348 Uuq ununquadium —	349 Uub ununbium —	350 Uuh ununhexium —	351 Uus ununseptium —	352 Uuo ununoctium —	353 Uut ununtrium —	354 Uuq ununquadium —	355 Uub ununbium —	356 Uuh ununhexium —	357 Uus ununseptium —	358 Uuo ununoctium —	359 Uut ununtrium —	360 Uuq ununquadium —	361 Uub ununbium —	362 Uuh ununhexium —	363 Uus ununseptium —	364 Uuo ununoctium —	365 Uut ununtrium —	366 Uuq ununquadium —	367 Uub ununbium —	368 Uuh ununhexium —	369 Uus ununseptium —	370 Uuo ununoctium —	371 Uut ununtrium —	372 Uuq ununquadium —	373 Uub ununbium —	374 Uuh ununhexium —	375 Uus ununseptium —	376 Uuo ununoctium —	377 Uut ununtrium —	378 Uuq ununquadium —	379 Uub ununbium —	380 Uuh ununhexium —	381 Uus ununseptium —	382 Uuo ununoctium —	383 Uut ununtrium —	384 Uuq ununquadium —	385 Uub ununbium —	386 Uuh ununhexium —	387 Uus ununseptium —	388 Uuo ununoctium —	389 Uut ununtrium —	390 Uuq ununquadium —	391 Uub ununbium —	392 Uuh ununhexium —	393 Uus ununseptium —	394 Uuo ununoctium —	395 Uut ununtrium —	396 Uuq ununquadium —	397 Uub ununbium —	398 Uuh ununhexium —	399 Uus ununseptium —	400 Uuo ununoctium —	401 Uut ununtrium —	402 Uuq ununquadium —	403 Uub ununbium —	404 Uuh ununhexium —	405 Uus ununseptium —	406 Uuo ununoctium —	407 Uut ununtrium —	408 Uuq ununquadium —	409 Uub ununbium —	410 Uuh ununhexium —	411 Uus ununseptium —	412 Uuo ununoctium —	413 Uut ununtrium —	414 Uuq ununquadium —	415 Uub ununbium —	416 Uuh ununhexium —	417 Uus ununseptium —	418 Uuo ununoctium —	419 Uut ununtrium —	420 Uuq ununquadium —	421 Uub ununbium —	422 Uuh ununhexium —	423 Uus ununseptium —	424 Uuo ununoctium —	425 Uut ununtrium —	426 Uuq ununquadium —	427 Uub ununbium —	428 Uuh ununhexium —	429 Uus ununseptium —	430 Uuo ununoctium —	431 Uut ununtrium —	432 Uuq ununquadium —	433 Uub ununbium —	434 Uuh ununhexium —	435 Uus ununseptium —	436 Uuo ununoctium —	437 Uut ununtrium —	438 Uuq ununquadium —	439 Uub ununbium —	440 Uuh ununhexium —	441 Uus ununseptium —	442 Uuo ununoctium —	443 Uut ununtrium —	444 Uuq ununquadium —	445 Uub ununbium —	446 Uuh ununhexium —	447 Uus ununseptium —	448 Uuo ununoctium —	449 Uut ununtrium —	450 Uuq ununquadium —	451 Uub ununbium —	452 Uuh ununhexium —	453 Uus ununseptium —	454 Uuo ununoctium —	455 Uut ununtrium —	456 Uuq ununquadium —	457 Uub ununbium —	458 Uuh ununhexium —	459 Uus ununseptium —	460 Uuo ununoctium —	461 Uut ununtrium —	462 Uuq ununquadium —	463 Uub ununbium —	464 Uuh ununhexium —	465 Uus ununseptium —	466 Uuo ununoctium —	467 Uut ununtrium —	468 Uuq ununquadium —	469 Uub ununbium —	470 Uuh ununhexium —	471 Uus ununseptium —	472 Uuo ununoctium —	473 Uut ununtrium —	474 Uuq ununquadium —	475 Uub ununbium —	476 Uuh ununhexium —	477 Uus ununseptium —	478 Uuo ununoctium —	479 Uut ununtrium —	480 Uuq ununquadium —	481 Uub ununbium —	482 Uuh ununhexium —	483 Uus ununseptium —	484 Uuo ununoctium —	485 Uut ununtrium —	486 Uuq ununquadium —	487 Uub ununbium —	488 Uuh ununhexium —	489 Uus ununseptium —	490 Uuo ununoctium —	491 Uut ununtrium —	492 Uuq ununquadium —	493 Uub ununbium —	494 Uuh ununhexium —	495 Uus ununseptium —	496 Uuo ununoctium —	497 Uut ununtrium —	498 Uuq ununquadium —	499 Uub ununbium —	500 Uuh ununhexium —	501 Uus ununseptium —	502 Uuo ununoctium —	503 Uut ununtrium —	504 Uuq ununquadium —	505 Uub ununbium —	506 Uuh ununhexium —	507 Uus ununseptium —	508 Uuo ununoctium —	509 Uut ununtrium —	510 Uuq ununquadium —	511 Uub ununbium —	512 Uuh ununhexium —	513 Uus ununseptium —	514 Uuo ununoctium —	515 Uut ununtrium —	516 Uuq ununquadium —	517 Uub ununbium —	518 Uuh ununhexium —	519 Uus ununseptium —	520 Uuo ununoctium —	521 Uut ununtrium —	522 Uuq ununquadium —	523 Uub ununbium —	524 Uuh ununhexium —	525 Uus ununseptium —	526 <

lanthanoids

actinoids

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
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 dm³ at room temperature and pressure (r.t.p.)