Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **February/March 2017**

45 minutes

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

* 2 7 2 1 7 4 1 0 1 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 16.
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 **16** printed pages.

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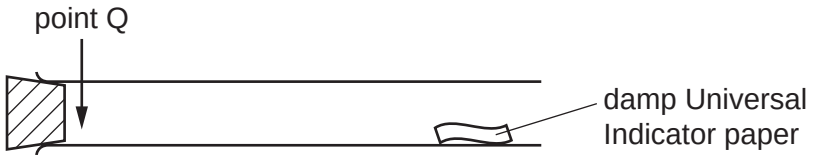
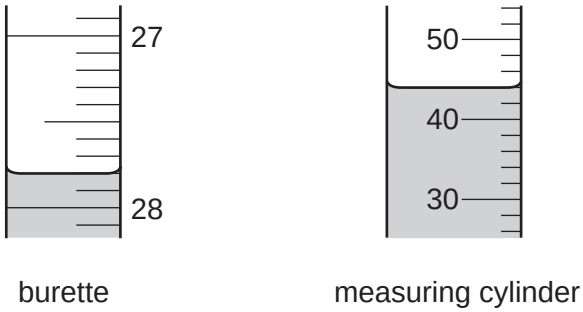
1 A gas is released at point Q in the apparatus shown.



Which gas changes the colour of the damp Universal Indicator paper most quickly?

	gas	relative molecular mass
A	ammonia	17
B	carbon dioxide	44
C	chlorine	71
D	hydrogen	2

2 The diagrams show liquids in a burette and a measuring cylinder.



Which row shows the correct readings for the burette and the measuring cylinder?

	burette	measuring cylinder
A	27.8	42
B	27.8	44
C	28.2	42
D	28.2	44

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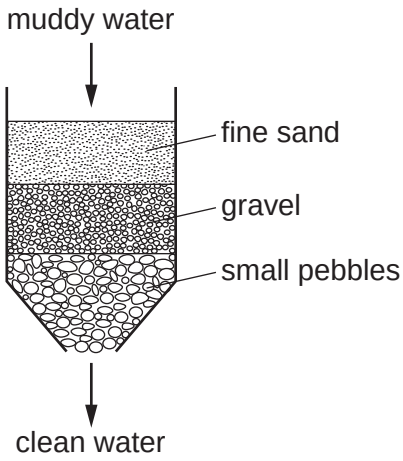
3 The diagram shows how muddy water can be purified.



Which process for purifying the muddy water is shown?

A crystallisation

B distillation

C filtration

D solvent extraction

4 Which statement explains why isotopes of an element have the same chemical properties?

A They have different numbers of neutrons.

B They have the same number of electrons as protons.

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

D They have the same number of protons in the nucleus.

5 The formulae of some ions are shown.

positive ions	negative ions
Al^{3+}	Br^-
Ca^{2+}	CO_3^{2-}
Cu^{2+}	NO_3^-
Fe^{3+}	S^{2-}
K^+	SO_4^{2-}

In which row is the formula **not** correct?

	compound	formula
A	aluminium sulfate	$Al_2(SO_4)_3$
B	calcium nitrate	$Ca(NO_3)_2$
C	iron(III) bromide	Fe_3Br
D	potassium sulfide	K_2S

6 Diamond and silicon(IV) oxide both have giant structures.

Which statements are correct?

1 Both substances are compounds.

2 There are strong covalent bonds in diamond.

3 Silicon(IV) oxide is bonded ionically.

4 Both substances have very high melting points.

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

7 Which statement about metals is correct?

A Layers of positive ions can slide over each other making metals malleable.

B Metallic bonding consists of a lattice of negative ions in a sea of delocalised electrons.

C Metallic bonding consists of a lattice of positive ions in a sea of delocalised negative ions.

D Metals conduct electricity because positive ions are free to move.

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8 The gas hydrazine has the molecular formula N_2H_4.

Hydrazine burns in air to form nitrogen gas and steam.

$$N_2H_4(g) + O_2(g) \rightarrow N_2(g) + 2H_2O(g)$$

Which statements are correct?

1 1 mole of hydrazine gives 72 dm^3 of gaseous products when it reacts with oxygen at room temperature and pressure.

2 The empirical formula of hydrazine is NH_2.

3 The total number of atoms in 1 mole of hydrazine is 6 × the Avogadro constant.

4 The volume of 1 mole of hydrazine at room temperature and pressure is 6 × 24 dm^3.

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

9 Copper(II) carbonate is broken down by heating to form copper(II) oxide and carbon dioxide gas.

The equation for the reaction is shown.

$$CuCO_3 \rightarrow CuO + CO_2$$

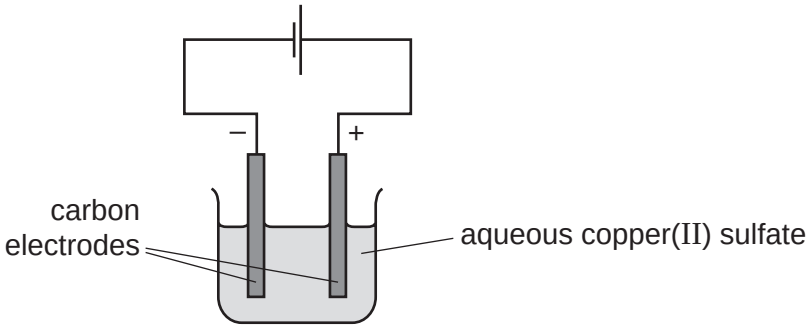
31.0 g of copper(II) carbonate are heated until all of the contents of the test-tube have turned from green to black.

The yield of copper(II) oxide formed is 17.5 g.

What is the percentage yield?

A 19.02% **B** 21.88% **C** 56.50% **D** 87.50%

10 The diagram shows the electrolysis of aqueous copper(II) sulfate.



Which statement is correct?

A Copper metal is deposited at the positive electrode.

B In the external circuit the electrons move from positive to negative.

C In the solution the electrons move from negative to positive.

D Oxygen gas is produced at the positive electrode.

11 Four solutions are separately electrolysed.

experiment	solution	electrodes
1	dilute aqueous sodium chloride	carbon
2	aqueous copper(II) sulfate	copper
3	concentrated hydrochloric acid	carbon
4	dilute sulfuric acid	carbon

In which two experiments is a colourless gas evolved at the anode?

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

12 Ammonia is made by reacting nitrogen with hydrogen in the presence of an iron catalyst.

The reaction is exothermic.

The equation for the reaction is shown.

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

The bond energies are shown in the table.

bond	bond energy in kJ / mol
H–H	436
N–H	390
N≡N	945

What is the energy given out during this reaction?

A –4593 kJ / mol **B** –1083 kJ / mol **C** –959 kJ / mol **D** –87 kJ / mol

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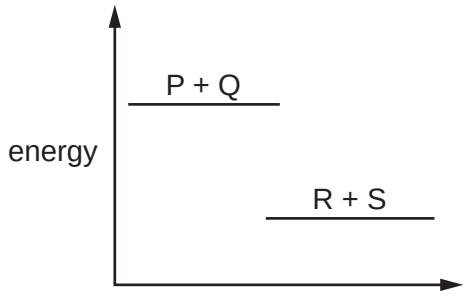
13 The energy level diagram for the reaction between P and Q to form R and S is shown.



Which row describes the energy changes involved and the type of reaction?

	energy changes involved	type of reaction
A	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	endothermic
B	more energy is given out when the bonds in the products are formed than is needed to break the bonds in the reactants	exothermic
C	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	endothermic
D	more energy is needed to break the bonds in the reactants than is given out when the bonds in the products are formed	exothermic

14 Copper(II) carbonate reacts with dilute sulfuric acid.

$$CuCO_3(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + CO_2(g) + H_2O(l)$$

The rate of the reaction can be changed by varying the conditions.

Which changes always increase the rate of this chemical reaction?

1 increasing the concentration of sulfuric acid

2 increasing the size of the pieces of copper(II) carbonate

3 increasing the temperature

4 increasing the volume of sulfuric acid

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

15 Which reaction is **not** affected by the presence of light?

A a candle burning

B methane reacting with chlorine

C photosynthesis

D silver bromide decomposing to form silver

16 The equation for the reversible reaction between hydrogen and iodine to form hydrogen iodide is shown.

The colours of the reactants and products are shown.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$$

colourless purple colourless

The forward reaction is exothermic.

Which statement is correct?

A An increase in pressure has no effect on the equilibrium position.

B The purple colour fades when the reaction mixture is heated.

C When equilibrium is reached, both forward and reverse reactions stop.

D When more hydrogen gas is added, the purple colour increases.

17 Chlorine displaces bromine from a solution of potassium bromide.

$$Cl_2 + 2KBr \rightarrow 2KCl + Br_2$$

What is the oxidising agent in this reaction?

A bromide ions

B bromine

C chloride ions

D chlorine

18 Beryllium oxide reacts with both sulfuric acid and aqueous sodium hydroxide.

Which type of oxide is beryllium oxide?

A acidic

B amphoteric

C basic

D neutral

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19 A student investigates two acids W and X.

The same volumes of W and X are reacted separately with excess magnesium.

The student makes the following observations.

1 Hydrogen gas is produced at a faster rate with W than with X.

2 The total volume of hydrogen gas produced is the same for both acids.

Which statement explains these observations?

A The pH of W is higher than the pH of X.

B W is an organic acid.

C W is a stronger acid than X.

D W is more concentrated than X.

20 A student is given an unknown solution.

Which two tests provide evidence that the solution is copper(II) sulfate?

1 adding dilute hydrochloric acid

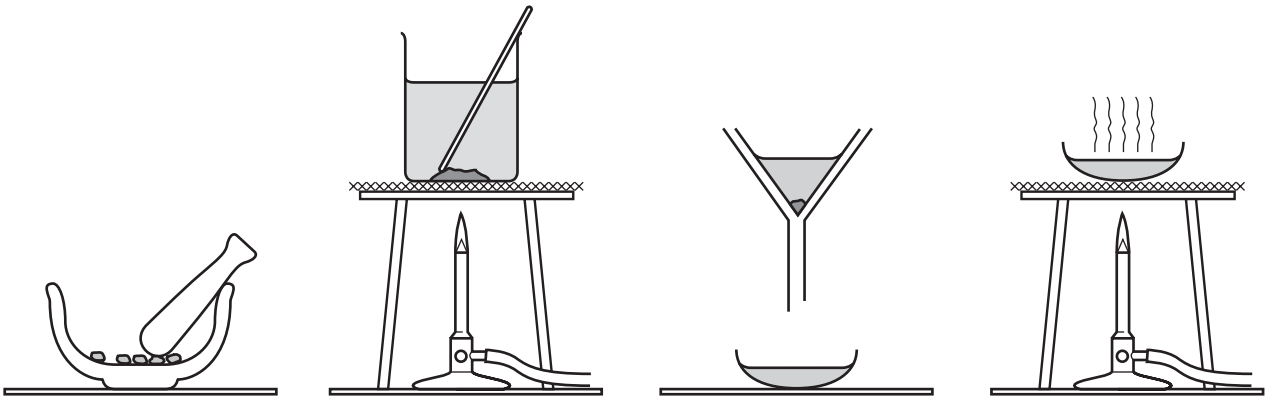
2 adding aqueous sodium hydroxide

3 adding dilute nitric acid, then silver nitrate solution

4 adding dilute nitric acid, then barium nitrate solution

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

21 The diagram shows the steps in the preparation of a salt.



step 1 step 2 step 3 step 4

Which salt is prepared by this method?

A barium sulfate

B copper(II) sulfate

C potassium sulfate

D sodium sulfate

22 Which property of elements increases across a period of the Periodic Table?

A metallic character

B number of electron shells

C number of outer shell electrons

D tendency to form positive ions

23 Magnesium, calcium, strontium and barium are Group II elements.

Group II elements follow the same trends as Group I elements.

Which statements about Group II elements are correct?

1 Calcium reacts faster than magnesium with water.

2 Barium reacts less vigorously than magnesium with dilute acid.

3 Strontium oxidises in air more slowly than barium.

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

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.

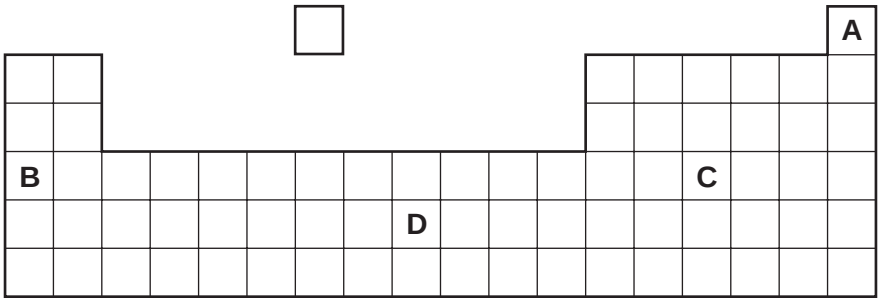
B They all have full outer shells.

C They are all gases.

D They are all monoatomic.

25 Part of the Periodic Table is shown.

Which element is used as a catalyst?



26 Which statement about **all** metals is correct?

A They are attracted to a magnet.

B They are weak and brittle.

C They may be used to form alloys.

D They react with water.

27 Which substance produces sulfur dioxide when roasted in air?

A bauxite

B cryolite

C hematite

D zinc blende

28 Which metal carbonate does **not** produce carbon dioxide when it is heated with a Bunsen burner?

A copper(II) carbonate

B magnesium carbonate

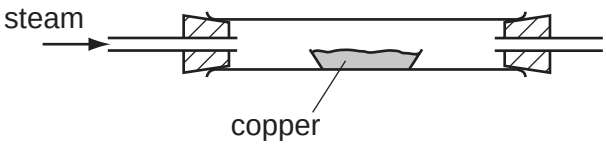
C sodium carbonate

D zinc carbonate

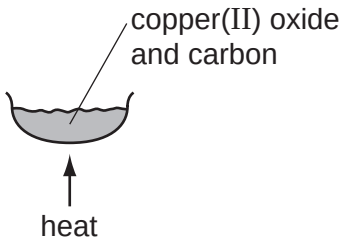
29 Two experiments are carried out.

In experiment 1, copper is heated with steam.

In experiment 2, copper(II) oxide is heated with carbon.



experiment 1



experiment 2

Which row describes what happens in experiments 1 and 2?

	experiment 1	experiment 2
A	no reaction	no reaction
B	no reaction	reaction
C	reaction	no reaction
D	reaction	reaction

30 Which two gases are obtained from liquid air by fractional distillation?

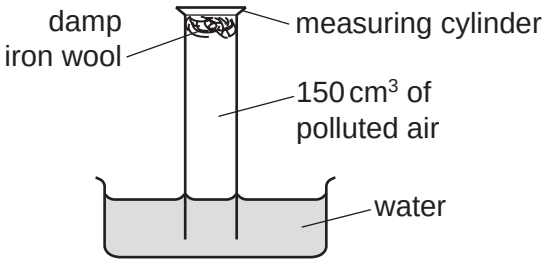
A carbon dioxide and oxygen

B carbon dioxide and water vapour

C nitrogen and oxygen

D nitrogen and water vapour

31 An experiment to find the percentage of oxygen in 150 cm^3 of polluted air is shown.



The apparatus is left for one week.

After this time, the volume of gas in the measuring cylinder is 122 cm^3.

What is the percentage of oxygen, to the nearest whole number, in the polluted air?

A 19% **B** 21% **C** 28% **D** 81%

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32 Two reactions, X and Y, produce carbon dioxide.

$$CH_4 \xrightarrow{X} CO_2 \xleftarrow{Y} CaCO_3$$

Which types of reaction are X and Y?

	X	Y
A	combustion	combustion
B	combustion	thermal decomposition
C	thermal decomposition	combustion
D	thermal decomposition	thermal decomposition

33 The ions present in ammonium sulfate are formed from the products of the Contact and Haber processes.

Both of these processes involve the use of a catalyst.

Which row is correct?

	ion	formed from	process	catalyst
A	ammonium	ammonia	Contact	iron
B	ammonium	ammonia	Haber	vanadium(V) oxide
C	sulfate	sulfuric acid	Contact	vanadium(V) oxide
D	sulfate	sulfuric acid	Haber	iron

34 The table shows the composition of four different types of petroleum.

fraction	Arabian Heavy /%	Arabian Light /%	Iranian Heavy /%	North Sea /%
gasoline	18	21	21	23
kerosene	11	15	13	15
diesel oil	18	21	20	24
fuel oil	53	43	46	38

Which type of petroleum is best for the motor vehicle industry?

A Arabian Heavy

B Arabian Light

C Iranian Heavy

D North Sea

35 Which reaction of ethene is **not** an addition reaction?

A reaction with bromine

B reaction with hydrogen

C reaction with oxygen

D reaction with steam

36 Ethanol is a fuel used in cars. It can be made from petroleum.

$C_4H_{10} \rightarrow C_2H_4 + C_2H_6$ cracking

$C_2H_4 + H_2O \rightarrow C_2H_5OH$ producing ethanol

$C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$ burning

Compounds of how many homologous series appear in these equations?

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

37 Ethanol is produced from either ethene or sugar.

Which type of chemical reaction is used in each case?

	ethene → ethanol	sugar → ethanol
A	addition	fermentation
B	addition	fractional distillation
C	distillation	fermentation
D	distillation	fractional distillation

38 The structural formula of an organic compound is shown.

$CH_3CH_2COOCH_3$

What is the name of this compound?

A butanoic acid

B ethyl ethanoate

C methyl propanoate

D propyl methanoate

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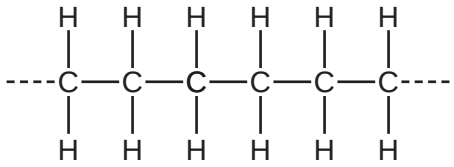
39 The diagram shows the structure of an important product.



This product is formed by ….. 1 …… of an …… 2 …… .

Which words complete gaps 1 and 2?

	1	2
A	addition polymerisation	alkane
B	addition polymerisation	alkene
C	cracking	alkane
D	cracking	alkene

40 Which pair of compounds reacts to form a condensation polymer?

A CH_3COOH and $C_2H_5NH_2$

B $HCOOH$ and HOC_2H_4OH

C $HOC_6H_{12}OH$ and $HOOCC_3H_6COOH$

D $H_2NC_2H_4NH_2$ and HOC_3H_6OH

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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.).

PMT