Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/21**

Paper 2 Multiple Choice (Extended) **October/November 2019**

45 minutes

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

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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.

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 **13** printed pages and **3** blank pages.

1 Samples of four gases are released in a room at the same time.

The gases are carbon dioxide, CO_2, hydrogen chloride, HCl, hydrogen sulfide, H_2S, and nitrogen dioxide, NO_2.

Which gas diffuses fastest?

A carbon dioxide

B hydrogen chloride

C hydrogen sulfide

D nitrogen dioxide

2 A student is asked to measure the time taken for 0.4 g of magnesium carbonate to react completely with 25.0 cm^3 of dilute hydrochloric acid.

Which pieces of apparatus does the student need?

A balance, stop-clock, pipette

B balance, stop-clock, thermometer

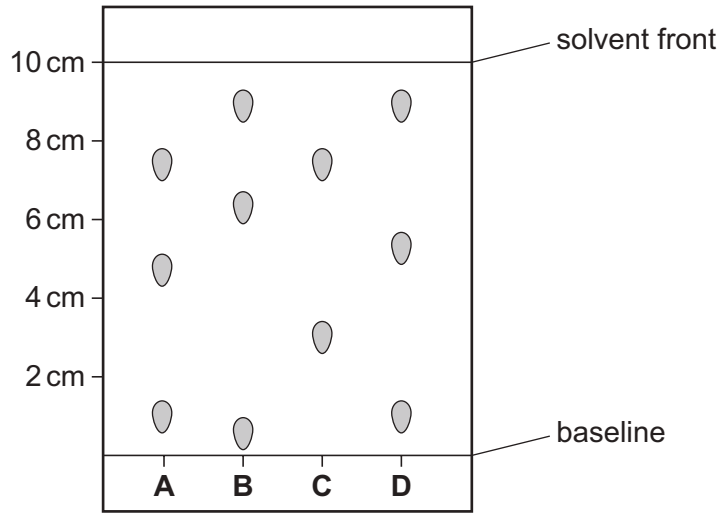
C balance, pipette, thermometer

D stop-clock, pipette, thermometer

3 Four different food colourings are analysed using chromatography.

The results are shown on the chromatogram. The diagram is not drawn to scale.

Which food colouring contains a component with an R_f value of 0.3?



4 Which statement about an ionic compound is **not** correct?

A It conducts electricity when dissolved in water.

B It has a high melting point due to strong attractive forces between ions.

C It has a regular lattice of oppositely charged ions in a 'sea of electrons'.

D The ionic bonds are formed between metallic and non-metallic elements.

5 An isotope of chromium is represented by $^{52}_{24}\mathrm{Cr}$.

Which statement about an atom of this isotope of chromium is correct?

A It contains 24 electrons.

B It contains 24 neutrons.

C It contains 28 protons.

D It contains 52 neutrons.

6 Element X has two isotopes, $^{12}_{6}\mathrm{X}$ and $^{14}_{6}\mathrm{X}$.

Which statement about these isotopes is correct?

A They have different chemical properties because they have different numbers of neutrons.

B They have the same chemical properties because they have the same number of outer shell electrons.

C They have the same nucleon number because the sum of the number of protons and electrons is the same.

D They have different positions in the Periodic Table because they have different numbers of neutrons.

7 How are the structures of diamond and silicon(IV) oxide similar?

A Molecules of both diamond and silicon(IV) oxide are held together by weak attractive forces.

B They both contain atoms arranged in planes held together by weak bonds.

C They both contain ions that are free to move.

D The carbon in diamond and the silicon in silicon(IV) oxide each have four covalent bonds.

8 Which statement describes the structure of copper?

A It has a lattice of negative ions in a 'sea of electrons'.

B It has a lattice of negative ions in a 'sea of protons'.

C It has a lattice of positive ions in a 'sea of electrons'.

D It has a lattice of positive ions in a 'sea of protons'.

9 Four fertilisers are each supplied in 100 kg bags.

Which fertiliser supplies the greatest mass of nitrogen per 100 kg bag?

A ammonium nitrate, NH_4NO_3

B ammonium phosphate, $(NH_4)_3PO_4$

C ammonium sulfate, $(NH_4)_2SO_4$

D urea, $CO(NH_2)_2$

10 Calcium carbonate reacts with dilute hydrochloric acid.

The equation for the reaction is shown.

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$$

1.00 g of calcium carbonate is added to 50.0 cm^3 of 0.0500 mol / dm^3 hydrochloric acid.

Which volume of carbon dioxide is made in this reaction?

A 30 cm^3 **B** 60 cm^3 **C** 120 cm^3 **D** 240 cm^3

11 Which rows correctly show cathode and anode products from the electrolysis of the named electrolyte?

	electrolyte	cathode product	anode product
1	copper(II) sulfate solution using copper electrodes	copper	oxygen
2	molten lead(II) bromide	lead	bromine
3	dilute sodium bromide solution	hydrogen	oxygen
4	copper(II) sulfate solution using carbon electrodes	hydrogen	oxygen

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

12 What are the ionic half-equations for the electrode reactions during the electrolysis of concentrated aqueous sodium chloride?

	anode	cathode
A	$Cl_2 + 2e^- \rightarrow 2Cl^-$	$H_2 \rightarrow 2H^+ + 2e^-$
B	$2Cl^- \rightarrow Cl_2 + 2e^-$	$2H^+ + 2e^- \rightarrow H_2$
C	$H_2 \rightarrow 2H^+ + 2e^-$	$Cl_2 + 2e^- \rightarrow 2Cl^-$
D	$2H^+ + 2e^- \rightarrow H_2$	$2Cl^- \rightarrow Cl_2 + 2e^-$

13 Which statements about endothermic reactions are correct?

1 The energy of the products is greater than the energy of the reactants.

2 The energy of the reactants is greater than the energy of the products.

3 The temperature of the surroundings increases during the reaction.

4 The temperature of the surroundings decreases during the reaction.

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

14 Which gases are used to generate electricity in a fuel cell?

A carbon dioxide and oxygen

B hydrogen and methane

C hydrogen and oxygen

D methane and carbon dioxide

15 Which is a chemical change?

A boiling water

B cooking an egg

C dissolving sugar

D melting ice cubes

16 The rate of reaction between magnesium and dilute hydrochloric acid is increased by increasing the concentration of the acid.

How does this affect the reacting particles?

	collision rate of particles	proportion of particles with sufficient energy to react
A	increases	increases
B	increases	stays the same
C	stays the same	increases
D	stays the same	stays the same

17 Dinitrogen tetroxide, N_2O_4, is converted into nitrogen dioxide, NO_2, in a reversible reaction.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

The forward reaction is endothermic.

Which conditions give the highest equilibrium yield of nitrogen dioxide?

	pressure / atmospheres	temperature
A	2	high
B	2	low
C	50	high
D	50	low

18 The equation for the reaction between iron(II) sulfate and bromine is shown.

$$6FeSO_4 + 3Br_2 \rightarrow 2Fe_2(SO_4)_3 + 2FeBr_3$$

Which row identifies the oxidising agent and the reducing agent?

	oxidising agent	reducing agent
A	Br_2	$FeSO_4$
B	$FeSO_4$	Br_2
C	$FeBr_3$	$Fe_2(SO_4)_3$
D	$Fe_2(SO_4)_3$	$FeBr_3$

19 Which statement about amphoteric oxides is correct?

A They are made by combining an acidic oxide with a basic oxide.

B They react with water to give a solution of pH 7.

C They react with both acids and bases.

D They do not react with acids or bases.

20 Carbonic acid is a weak acid formed when carbon dioxide dissolves in water.

What is the pH of the solution?

A 1 **B** 5 **C** 7 **D** 9

21 A method used to make copper(II) sulfate crystals is shown.

1 Place dilute sulfuric acid in a beaker.

2 Warm the acid.

3 Add copper(II) oxide until it is in excess.

4 Filter the mixture.

5 Evaporate the filtrate until crystals start to form.

6 Leave the filtrate to cool.

What are the purposes of step 3 and step 4?

	step 3	step 4
A	to ensure all of the acid has reacted	to obtain solid copper(II) sulfate
B	to ensure all of the acid has reacted	to remove the excess of copper(II) oxide
C	to speed up the reaction	to obtain solid copper(II) sulfate
D	to speed up the reaction	to remove the excess of copper(II) oxide

22 Lead(II) sulfate is an insoluble salt.

Which process is **not** used to prepare a pure sample of this salt?

A crystallisation

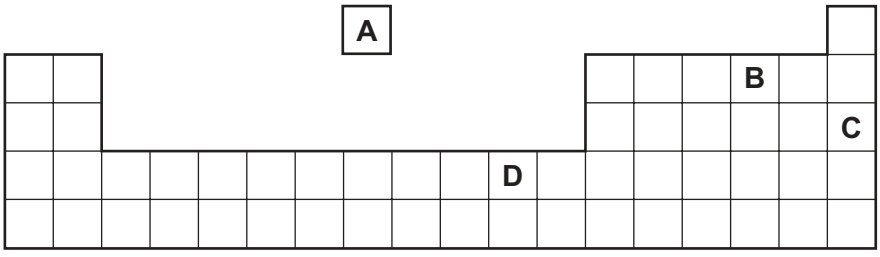
B drying

C filtration

D precipitation

23 Part of the Periodic Table is shown.

Which element is used to provide an inert atmosphere?



24 Which pair of elements reacts together most violently?

A chlorine and lithium

B chlorine and potassium

C iodine and lithium

D iodine and potassium

25 Which pair of compounds shows that transition elements have variable oxidation states?

A Cr_2O_3 and $CrBr_3$

B $CuSO_4$ and $CuCl_2$

C Fe_2O_3 and $FeCl_2$

D NiO and $NiCl_2$

26 Some properties of substance X are listed.

- It conducts electricity when molten.
- It has a high melting point.
- It burns in oxygen and the oxide dissolves in water to give a solution with pH 11.

What is X?

A a covalent compound

B a macromolecule

C a metal

D an ionic compound

27 Which statement is correct?

A Aluminium is used in the manufacture of aircraft because it has a high density.

B Copper is used for cooking utensils because it is a good conductor of heat.

C Mild steel is used for car bodies because it is resistant to corrosion.

D Stainless steel is used for cutlery because it is a conductor of electricity.

28 Iron rusts but aluminium does not easily corrode.

Which statement explains why aluminium does **not** easily corrode?

A It is an alloy.

B It is below iron in the reactivity series.

C It is not a transition element.

D Its surface is protected by an oxide layer.

29 Which statement about the extraction of aluminium is correct?

A Aluminium is formed at the cathode during the electrolysis of aluminium oxide.

B Hematite is mainly aluminium oxide.

C Molten cryolite is used to raise the melting point of the aluminium oxide.

D Oxygen gains electrons at the anode during the electrolysis of aluminium oxide.

30 River water contains soluble impurities, insoluble impurities and bacteria.

River water is made safe to drink by filtration and chlorination.

Which statement is correct?

A Filtration removes bacteria and insoluble impurities, and chlorination removes soluble impurities.

B Filtration removes insoluble impurities, and chlorination kills the bacteria.

C Filtration removes soluble and insoluble impurities, and chlorination kills the bacteria.

D Filtration removes soluble impurities and bacteria, and chlorination removes insoluble impurities.

31 Which physical property is used to separate the nitrogen and oxygen from air?

A boiling point

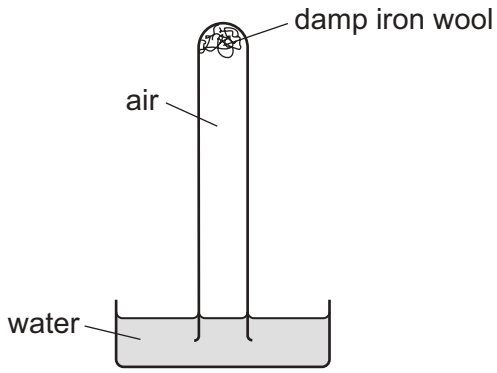
B density

C electrical conductivity

D molecular mass

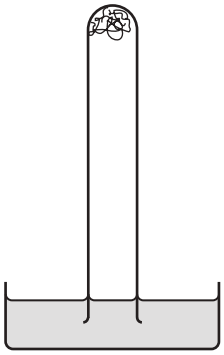
[Turn over

32 The apparatus shown is set up and left for a week.



Which diagram shows the level of the water at the end of the week?

A



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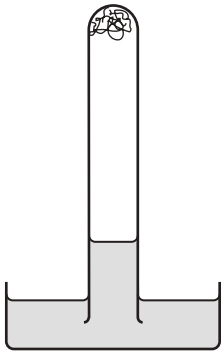

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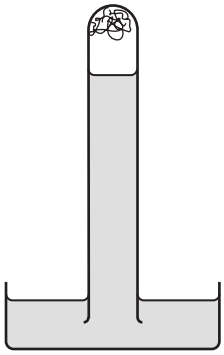

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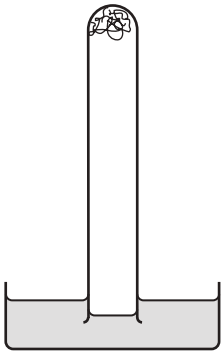


33 Which statement about the carbon cycle is correct?

A Carbon is absorbed from the atmosphere by combustion and released into it by respiration.

B Carbon is absorbed from the atmosphere by photosynthesis and released into it by combustion.

C Carbon is absorbed from the atmosphere by both respiration and combustion.

D Carbon is released into the atmosphere by both photosynthesis and respiration.

34 Ammonium sulfate is used as a fertiliser.

It is made from ammonia and sulfuric acid.

Which words complete gaps 1, 2 and 3?

The .....1..... is made by the .....2..... process in which .....3..... is used as a catalyst.

	1	2	3
A	ammonia	Contact	iron
B	ammonia	Haber	vanadium(V) oxide
C	sulfuric acid	Contact	vanadium(V) oxide
D	sulfuric acid	Haber	iron

35 Which process is used to obtain lime from limestone?

A cracking

B fractional distillation

C neutralisation

D thermal decomposition

36 Petroleum is separated by fractional distillation.

Which statement about the fractions produced is correct?

A Bottled gas for heating and cooking is obtained from the naphtha fraction.

B Diesel oil is used as a fuel for jet aircraft.

C Substances used to make polishes are obtained from the lubricating fraction.

D The kerosene fraction contains many useful waxes.

37 Which products are obtained by the cracking of an alkane?

	alkene	hydrogen	water
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

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

Which statement describes an advantage of fermentation compared to the catalytic addition of steam to ethene?

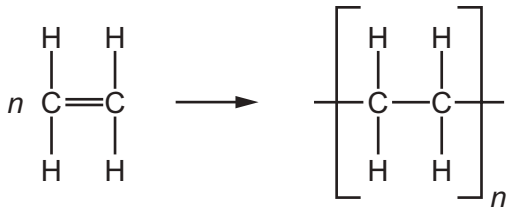
A Fermentation is a more rapid reaction.

B Fermentation produces a purer product.

C Fermentation uses a higher temperature.

D Fermentation uses renewable resources.

39 The diagram shows the structure of a monomer and of the polymer made from it.



What are the monomer and polymer?

	monomer	polymer
A	ethane	poly(ethane)
B	ethane	poly(ethene)
C	ethene	poly(ethane)
D	ethene	poly(ethene)

40 Which polymers possess the same linkage?

A nylon and protein

B protein and starch

C starch and nylon

D nylon and *Terylene*

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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.).