Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/21**

Paper 2 Multiple Choice (Extended) **May/June 2018**

45 minutes

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

* 1 2 6 4 6 6 1 6 1 2 *

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.

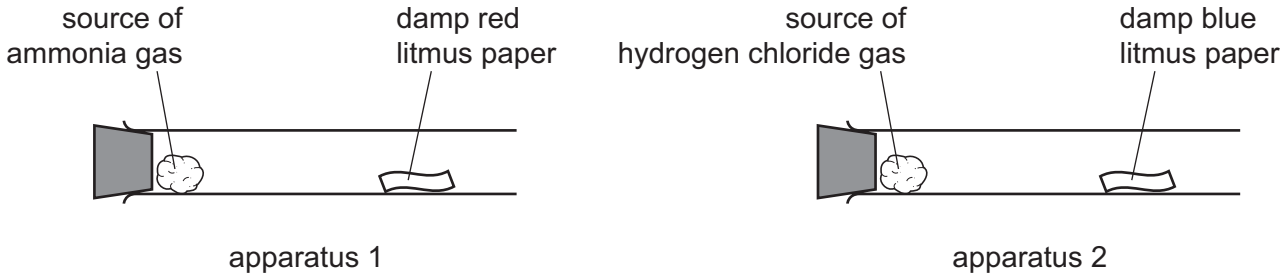
The syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

This document consists of **13** printed pages and **3** blank pages.

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1 A student investigated the diffusion of ammonia gas, NH_3, and hydrogen chloride gas, HCl.

Two sets of apparatus were set up as shown at room temperature and pressure.



The damp red litmus paper in apparatus 1 changed colour after 30 seconds.

How long does it take for the damp blue litmus paper to change colour in apparatus 2?

A 64 seconds

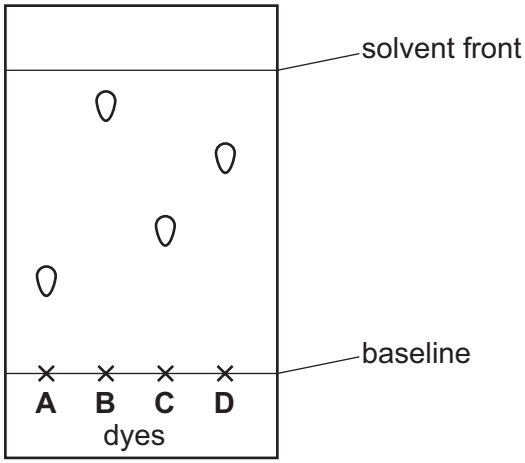
B 30 seconds

C 21 seconds

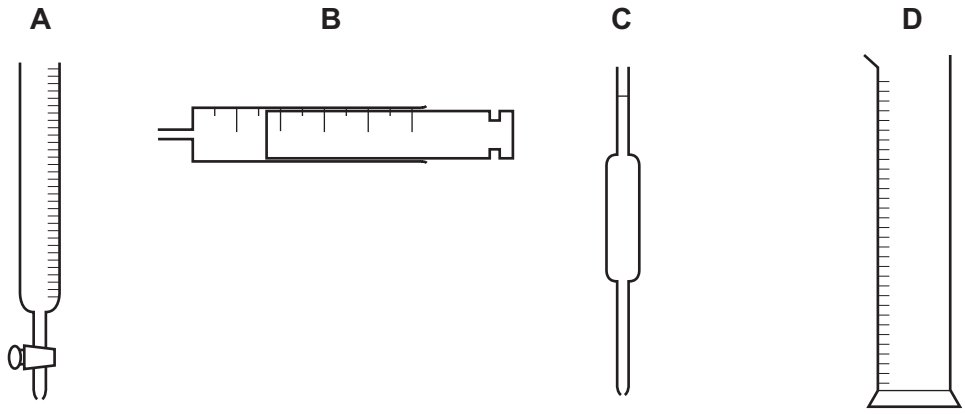
D The blue litmus paper would not change colour.

2 Chromatography is a technique used to separate coloured dyes.

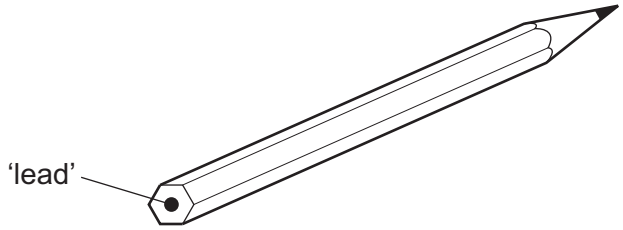
Which dye has an R_f value of 0.7?



3 Which piece of apparatus is used to measure exactly 26.3 cm^3 of a liquid?



4 The 'lead' in a pencil is made of a mixture of graphite and clay.



When the percentage of graphite is increased, the pencil slides across the paper more easily.

Which statement explains this observation?

A Graphite has a high melting point.

B Graphite is a form of carbon.

C Graphite is a lubricant.

D Graphite is a non-metal.

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5 Chlorine exists as two common isotopes, ^{35}Cl and ^{37}Cl.

Information about these two isotopes is shown.

	number of protons	number of neutrons	number of electron shells
^{35}Cl	17	18	3
^{37}Cl	17	20	3

Which statement explains why the two isotopes are of the same element?

A Both have the same number of electron shells.

B Both have the same number of protons.

C Both have 7 outer shell electrons.

D ^{37}Cl has 2 more neutrons than ^{35}Cl.

6 Which substance is **not** a macromolecule?

A diamond

B graphite

C silicon(IV) oxide

D sulfur

7 Copper is a metallic element.

Which statements about copper are correct?

1 Copper is malleable because layers of ions are in fixed positions and cannot move.

2 The structure of copper consists of negative ions in a lattice.

3 Copper conducts electricity because electrons can move through the metal.

4 Electrons hold copper ions together in a lattice by electrostatic attraction.

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

8 The equation for the combustion of ethane is shown.

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

Which volume of carbon dioxide, at room temperature and pressure, is formed when 0.5 moles of ethane burn?

A 48 dm^3 **B** 24 dm^3 **C** 12 dm^3 **D** 6 dm^3

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9 A solution of ethanoic acid, CH_3COOH, has a concentration of $2\,mol/dm^3$.

Which statement about this solution is correct?

A 20 g of ethanoic acid is dissolved in $10\,cm^3$ of water.

B 30 g of ethanoic acid is dissolved in $250\,cm^3$ of water.

C 60 g of ethanoic acid is dissolved in $1\,dm^3$ of water.

D 120 g of ethanoic acid is dissolved in $2\,dm^3$ of water.

10 Aqueous copper(II) sulfate is electrolysed using copper electrodes.

Which statement is correct?

A A reduction reaction occurs at the positive electrode.

B The blue colour of the solution becomes darker.

C The concentration of copper ions in the solution decreases.

D The mass of the negative electrode increases.

11 Dilute sulfuric acid is electrolysed using inert electrodes.

What are the ionic half-equations for the reactions that take place at each electrode?

	positive electrode	negative electrode
A	$2H^+ + 2e^- \rightarrow H_2$	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$
B	$2H^+ + 2e^- \rightarrow H_2$	$4OH^- + 4H^+ \rightarrow 4H_2O$
C	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$	$2H^+ + 2e^- \rightarrow H_2$
D	$4OH^- + 4H^+ \rightarrow 4H_2O$	$2H^+ + 2e^- \rightarrow H_2$

12 Plant cells use energy from sunlight for photosynthesis.

Which row describes and explains the energy change that occurs?

	type of energy change	explanation
A	endothermic	less energy is released making bonds than is absorbed to break bonds
B	endothermic	more energy is released making bonds than is absorbed to break bonds
C	exothermic	less energy is released making bonds than is absorbed to break bonds
D	exothermic	more energy is released making bonds than is absorbed to break bonds

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[Turn over

13 Hydrogen bromide decomposes to form hydrogen and bromine. The equation is shown.

$$2HBr(g) \rightarrow H_2(g) + Br_2(g)$$

The bond energies are shown in the table. The reaction is endothermic.

bond	bond energy in kJ / mol
Br–Br	+193
H–Br	+366
H–H	+436

What is the energy change for the reaction?

A +263 kJ / mol **B** +103 kJ / mol **C** –103 kJ / mol **D** –263 kJ / mol

14 Which row describes the effects of increasing both concentration and temperature on the collisions between reacting particles?

	increasing concentration	increasing temperature
A	more collisions per second only	more collisions per second only
B	more collisions per second and more collisions with sufficient energy to react	more collisions per second only
C	more collisions per second only	more collisions per second and more collisions with sufficient energy to react
D	more collisions per second and more collisions with sufficient energy to react	more collisions per second and more collisions with sufficient energy to react

15 The formation of sulfur trioxide is a reversible reaction.

The equation is shown.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction is exothermic.

Which conditions produce the highest equilibrium yield of sulfur trioxide?

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

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16 Chlorine displaces iodide ions from potassium iodide.

$$Cl_2 + 2I^- \rightarrow I_2 + 2Cl^-$$

What is the oxidising agent?

A chloride ions

B chlorine

C iodide ions

D iodine

17 Which statement about oxides is correct?

A A solution of magnesium oxide has a pH less than pH 7.

B A solution of sulfur dioxide has a pH greater than pH 7.

C Magnesium oxide reacts with nitric acid to make a salt.

D Sulfur dioxide reacts with hydrochloric acid to make a salt.

18 Which solution has the lowest pH?

A $0.1\,mol/dm^3$ ammonia solution

B $0.1\,mol/dm^3$ ethanoic acid

C $0.1\,mol/dm^3$ lithium hydroxide

D $0.1\,mol/dm^3$ nitric acid

19 A student mixes silver nitrate and barium chloride to form a white precipitate of silver chloride.

The equation is shown.

$$2AgNO_3 + BaCl_2 \rightarrow 2AgCl + Ba(NO_3)_2$$

Which row describes the solubility of the salts?

	soluble	insoluble
A	silver nitrate	barium chloride, barium nitrate and silver chloride
B	silver nitrate and barium chloride	barium nitrate and silver chloride
C	silver nitrate, barium chloride and barium nitrate	silver chloride
D	silver nitrate, barium chloride and silver chloride	barium nitrate

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[Turn over

20 Which methods are suitable for preparing **both** zinc sulfate and copper(II) sulfate?

1 reacting the metal oxide with warm dilute aqueous sulfuric acid

2 reacting the metal with dilute aqueous sulfuric acid

3 reacting the metal carbonate with dilute aqueous sulfuric acid

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

21 Which element is in the same period of the Periodic Table as silicon?

A germanium

B scandium

C sodium

D strontium

22 Which statement about the halogens is correct?

A A sample of bromine reacts with potassium chloride solution.

B A sample of bromine reacts with potassium iodide solution.

C A sample of chlorine has a higher density than a sample of bromine.

D A sample of chlorine is a darker colour than a sample of bromine.

23 Which row shows the catalytic activity of transition elements and their compounds?

	catalytic activity of transition elements	catalytic activity of compounds of transition elements
A	good	good
B	good	poor
C	poor	good
D	poor	poor

24 The following statements are made about the metals copper, iron, magnesium and zinc.

1 Their oxides are acidic.

2 They all conduct electricity in the solid state.

3 They all have high melting points.

4 They all react with dilute acids to form hydrogen.

Which statements are correct?

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

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25 Silver is a less reactive metal than cadmium.

Cadmium is a less reactive metal than barium.

Which statement is correct?

A Barium does not react when heated with silver oxide.

B Cadmium displaces barium from a solution of barium chloride.

C Cadmium displaces silver from a solution of silver nitrate.

D Cadmium reacts when heated with barium oxide.

26 Aluminium metal is extracted from aluminium oxide using electrolysis.

Which statement about the extraction process is **not** correct?

A A large amount of electricity is required.

B Molten cryolite is used to dissolve the aluminium oxide.

C Oxygen gas is released which reacts to form carbon dioxide.

D The negative electrodes burn away and have to be replaced.

27 Which statement explains why aluminium is used in the manufacture of aircraft?

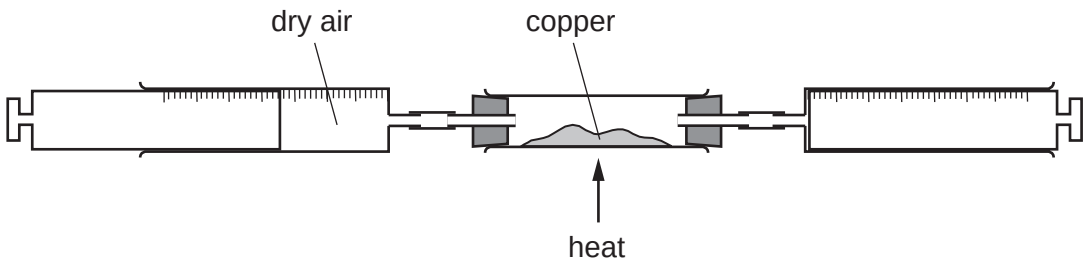
A It conducts heat well.

B It has a low density.

C It is a good conductor of electricity.

D It is easy to recycle.

28 Dry air is passed over hot copper until all the oxygen has reacted.



The volume of gas at the end of the reaction is 120 cm^3.

What is the starting volume of dry air?

A 132 cm^3 **B** 152 cm^3 **C** 180 cm^3 **D** 570 cm^3

29 A steel bicycle which had been left outdoors for several months was starting to rust.

What would **not** reduce the rate of corrosion?

A Remove the rust and paint the bicycle.

B Remove the rust and store the bicycle in a dry shed.

C Remove the rust and wipe the bicycle with a clean, damp cloth.

D Remove the rust and wipe the bicycle with an oily cloth.

30 Which statements about water are correct?

1 Household water contains dissolved salts.

2 Water for household use is filtered to remove soluble impurities.

3 Water is treated with chlorine to kill bacteria.

4 Water is used in industry for cooling.

A 1, 2, 3 and 4

B 1, 2 and 3 only

C 1, 3 and 4 only

D 2, 3 and 4 only

31 Ammonia is manufactured by reacting hydrogen with nitrogen in the Haber process.

Which row describes the sources of hydrogen and nitrogen and the conditions used in the manufacture of ammonia in the Haber process?

	source of hydrogen	source of nitrogen	temperature of reaction / ℃	pressure of reaction / atm
A	air	natural gas	250	2
B	air	natural gas	250	200
C	natural gas	air	450	2
D	natural gas	air	450	200

32 Which statements about the carbon cycle are correct?

1 Carbon dioxide is added to the atmosphere by respiration.

2 Carbon dioxide is added to the atmosphere by combustion of coal.

3 Carbon dioxide is removed from the atmosphere by photosynthesis.

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

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33 Which statement about sulfur and its compounds is **not** correct?

A Sulfur dioxide is used as a food preservative.

B Sulfur dioxide turns acidified aqueous potassium manganate(VII) from purple to colourless.

C Sulfur forms a basic oxide.

D Sulfur is used in the manufacture of sulfuric acid.

34 Which process is used to convert limestone (calcium carbonate) into lime?

A electrolysis

B fractional distillation

C incomplete combustion

D thermal decomposition

35 What is **not** the correct use of the fraction named?

	name of fraction	use
A	fuel oil	making waxes
B	gas oil	fuel in diesel engines
C	kerosene	jet fuel
D	naphtha	making chemicals

36 Which reaction is **not** a reaction which alkenes undergo?

A bromination

B hydration

C hydrogenation

D hydrolysis

37 Which substances can be obtained by cracking hydrocarbons?

A ethanol and ethene

B ethanol and hydrogen

C ethene and hydrogen

D ethene and poly(ethene)

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[Turn over

38 Ethanol is produced by fermentation or from ethene.

What is a disadvantage of producing ethanol by fermentation?

A Distillation is needed to purify the ethanol produced.

B Fermentation uses glucose from plants.

C Fermentation is catalysed by enzymes in yeast.

D Fermentation occurs at a low temperature and pressure.

39 Which structural formula represents methyl propanoate?

A $CH_3CH_2COOCH_3$

B $CH_3COOCH_2CH_2CH_3$

C $CH_3CH_2CH_2COOCH_3$

D $HCOOCH_2CH_2CH_3$

40 Which row describes addition polymerisation and condensation polymerisation?

	addition polymerisation	condensation polymerisation
A	monomers have a C=C double bond and the polymer is the only product	monomers have a C=C double bond and the polymer is the only product
B	monomers have a C=C double bond and the polymer is the only product	the monomers react to form the polymer and a small molecule
C	the monomers react to form the polymer and a small molecule	monomers have a C=C double bond and the polymer is the only product
D	the monomers react to form the polymer and a small molecule	the monomers react to form the polymer and a small molecule

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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.).