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Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **February/March 2018**

45 minutes

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

3036484056

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 **15** printed pages and **1** blank page.

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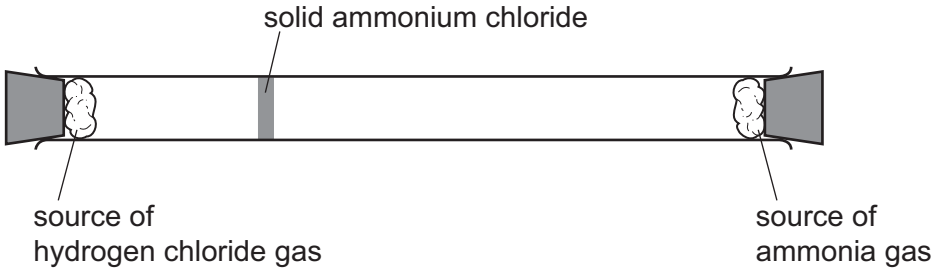
1 Hydrogen chloride gas, HC*l*, reacts with ammonia gas, NH_3, to form solid ammonium chloride.

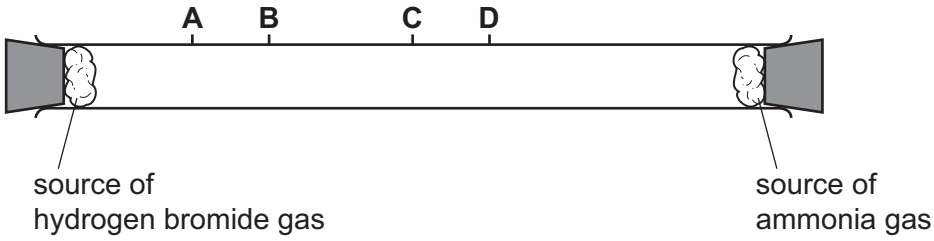
The apparatus is set up as shown.

After a few minutes, solid ammonium chloride forms where the two gases meet.



The experiment is repeated using hydrogen bromide, HBr, in place of hydrogen chloride.

How far along the tube does the solid ammonium bromide form?



2 Substance L melts at –7 °C and is a brown liquid at room temperature.

Which temperature is the boiling point of pure L?

A –77 °C

B –7 °C to +7 °C

C 59 °C

D 107 °C to 117 °C

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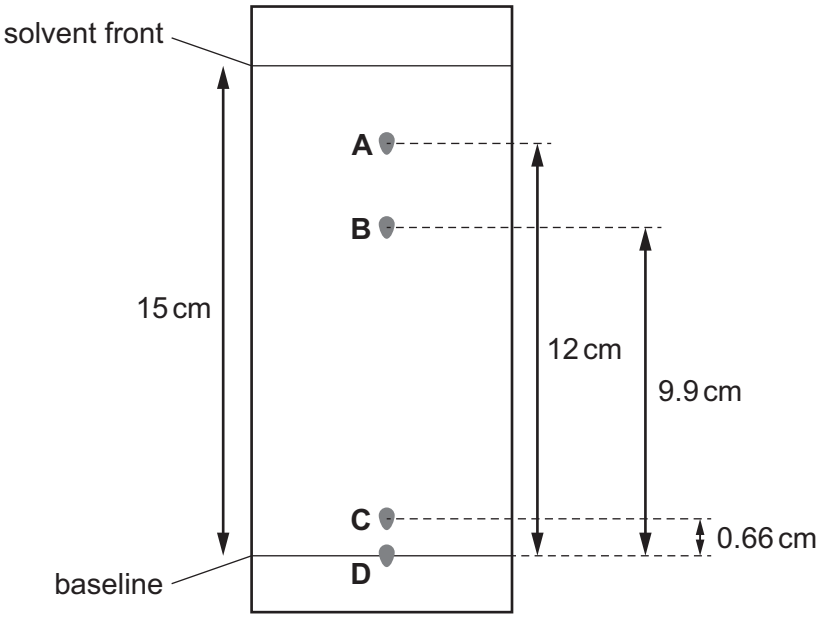
3 Chromatography is done on a mixture containing a drug. The drug has an R_f value of 0.66.

The diagram is **not** drawn to scale.

Which spot on the chromatogram represents the drug?



4 Caesium, Cs, is an element in Group I of the Periodic Table.

When caesium reacts it forms a positive ion, Cs^+.

How is a caesium ion formed?

A A caesium atom gains a proton.

B A caesium atom gains an electron.

C A caesium atom loses an electron.

D A caesium atom shares an electron.

5 The structure of copper is described as a lattice of positive ions in a 'sea of electrons'.

Which statements are correct?

1 Copper has a high melting point because of the strong electrostatic attraction between the positive ions and the 'sea of electrons'.

2 Copper is malleable because the layers of atoms in the lattice can slide over each other.

3 Copper atoms can be oxidised to form copper ions by losing electrons.

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

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6 Three statements about diamond, graphite and silicon(IV) oxide are listed.

1 Diamond and graphite both have giant covalent structures.

2 In silicon(IV) oxide, silicon and oxygen atoms are joined together by covalent bonds throughout the whole structure.

3 Diamond and silicon(IV) oxide have similar structures.

Which statements are correct?

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

7 The concentration of a hydrochloric acid solution is 0.5 mol / dm^3.

How many moles of hydrochloric acid are present in 25 cm^3 of this solution?

A 0.0125 **B** 0.0200 **C** 12.5 **D** 20.0

8 A sample of an iron oxide contains 50.4 g of iron and 21.6 g of oxygen.

What is the empirical formula of the iron oxide?

A FeO **B** FeO_3 **C** Fe_2O_3 **D** Fe_3O_2

9 A solution of copper(II) sulfate can be electrolysed using copper electrodes or carbon electrodes.

Which statements are correct?

1 Using copper electrodes, oxygen gas forms at the anode.

2 Using copper electrodes, copper atoms lose electrons at the anode.

3 Using carbon electrodes, copper metal forms at the cathode.

4 Using carbon electrodes, copper ions gain electrons at the cathode.

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

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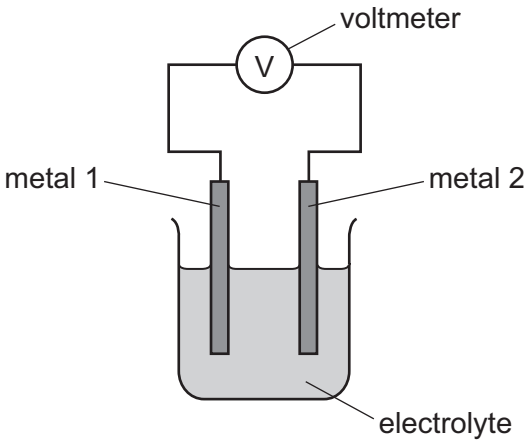
10 Pairs of metals are connected together to make a simple cell, as shown.



The table shows the reading on the voltmeter when different metals are used.

		metal 2			
		beryllium	cerium	cobalt	manganese
metal 1	beryllium	0.00 V	+0.64 V	–1.57 V	–0.67 V
	cerium		0.00 V	–2.21 V	–1.30 V
	cobalt			0.00 V	+0.90 V
	manganese				0.00 V

If metal 2 is more reactive than metal 1, the voltage measured is positive.

The greater the difference in reactivity of the metals, the larger the reading on the voltmeter.

What is the order of reactivity?

	most reactive →			least reactive
A	cerium	beryllium	cobalt	manganese
B	cerium	beryllium	manganese	cobalt
C	cobalt	manganese	beryllium	cerium
D	cobalt	manganese	cerium	beryllium

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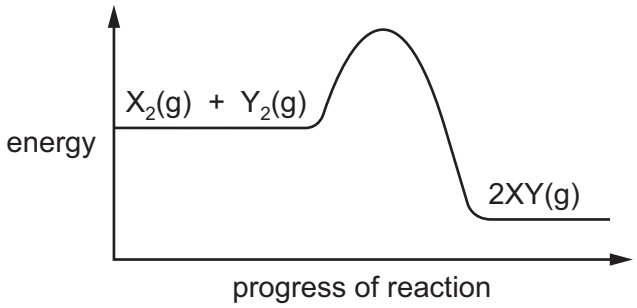
11 The energy level diagram for the reaction between X_2 and Y_2 to form XY gas is shown.



Which statement is correct?

A Energy is released when X_2 and Y_2 bonds are broken.

B Energy is needed to form XY bonds.

C The energy change, ΔH, for the reaction is negative.

D The reaction is endothermic.

12 Methane burns in oxygen to form carbon dioxide and water.

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–H	+410
C=O	+805
O–H	+460
O=O	+496

What is the energy change for the reaction?

A –818 kJ / mol

B –323 kJ / mol

C +323 kJ / mol

D +818 kJ / mol

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13 Methanol is made by reacting carbon monoxide with hydrogen. The reaction is reversible.

$$CO(g) + 2H_2(g) \rightleftharpoons CH_3OH(g)$$

The forward reaction is exothermic.

Which combination of temperature and pressure gives the highest equilibrium yield of methanol?

	temperature / °C	pressure / atmospheres
A	200	10
B	200	200
C	600	10
D	600	200

14 The ionic equation for the reaction between zinc and aqueous copper ions is shown.

$$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$$

Which statement about this reaction is correct?

A Copper ions are oxidised and their oxidation state changes.

B Copper ions are reduced because they lose electrons.

C Zinc atoms are oxidised and their oxidation state changes.

D Zinc atoms are reduced because they gain electrons.

15 In which reaction is the rate of reaction **not** affected by light?

A the conversion of carbon dioxide and water to glucose and oxygen in green plants

B the reaction of bromine with ethene

C the reaction of chlorine with methane

D the reduction of silver ions to silver

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16 Calcium carbonate reacts with dilute hydrochloric acid to form bubbles of carbon dioxide.

At a higher temperature, the same reaction is faster.

Which row explains this observation?

	collision rate	number of molecules with sufficient energy to react
A	increases	more
B	increases	the same
C	stays the same	more
D	stays the same	the same

17 Ethanoic acid reacts with water to produce an acidic solution.

Which row describes the roles of ethanoic acid and water in this reaction?

	ethanoic acid	water
A	accepts a proton	donates a proton
B	accepts an electron	donates an electron
C	donates a proton	accepts a proton
D	donates an electron	accepts an electron

18 A solution of compound Z gives a light blue precipitate with aqueous ammonia. The precipitate dissolves in an excess of ammonia.

A flame test is done on compound Z.

What is the colour of the flame?

A blue-green

B lilac

C red

D yellow

19 Carbon, copper, magnesium, sodium and sulfur can all form oxides.

How many of these elements form acidic oxides?

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

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20 Which method is used to make the salt copper(II) sulfate?

A dilute acid + alkali

B dilute acid + carbonate

C dilute acid + metal

D dilute acid + non-metal oxide

21 The Periodic Table lists all the known elements.

Elements are arranged in order of .....1..... number.

The melting points of Group I elements .....2..... down the group.

The melting points of Group VII elements .....3..... down the group.

Which words correctly complete gaps 1, 2 and 3?

	1	2	3
A	nucleon	decrease	increase
B	nucleon	increase	decrease
C	proton	decrease	increase
D	proton	increase	decrease

22 Metal X reacts with non-metal Y to form an ionic compound with the formula X_2Y.

Which statements are correct?

1 X is in Group I of the Periodic Table.

2 X is in Group II of the Periodic Table.

3 Y is in Group VI of the Periodic Table.

4 Y is in Group VII of the Periodic Table.

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

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23 Which statements about Group I and Group VII elements are correct?

1 In Group I, lithium is more reactive than potassium.

2 In Group VII, chlorine is more reactive than fluorine.

	statement 1	statement 2
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

24 Which two properties are physical properties of **all** pure metals?

	property 1	property 2
A	brittle	poor conductor of heat
B	good conductor of electricity	malleable
C	good conductor of heat	low melting point
D	malleable	low density

25 Aluminium is extracted from aluminium oxide using electrolysis.

Carbon dioxide is formed in this process.

Which equation shows the formation of carbon dioxide during the extraction of aluminium from aluminium oxide by electrolysis?

A $Al_2(CO_3)_3 \rightarrow Al_2O_3 + 3CO_2$

B $Al_2O_3 + 3CO \rightarrow 2Al + 3CO_2$

C $C + O_2 \rightarrow CO_2$

D $C^{4+} + 2O^{2-} \rightarrow CO_2$

26 A sample of solid X was added to three different solutions to predict the position of X in the reactivity series.

$$X(s) + FeSO_4(aq) \rightarrow \text{no reaction}$$

$$X(s) + 2HCl(aq) \rightarrow XCl_2(aq) + H_2(g)$$

$$X(s) + Zn(NO_3)_2(aq) \rightarrow \text{no reaction}$$

Which other solution would react with solid X?

A $CaSO_4(aq)$ **B** $CuSO_4(aq)$ **C** $MgSO_4(aq)$ **D** $Na_2SO_4(aq)$

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27 Which statement about the uses of aluminium, copper and iron is correct?

A Aluminium is used for aircraft manufacture because it has a high density.

B Aluminium is used for food containers because it is a good conductor of electricity.

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

D Stainless steel is used for car bodies because it corrodes easily.

28 Air is a mixture of gases.

The melting and boiling points of some gases present in clean, dry air are shown.

In the fractional distillation of liquid air, which gas boils first?

	gas	melting point / °C	boiling point / °C
A	argon	–189	–186
B	krypton	–157	–153
C	nitrogen	–210	–196
D	oxygen	–219	–183

29 Water must be purified before it is suitable for use in the home.

Which processes are used to remove solid impurities and to kill bacteria?

	to remove solid impurities	to kill bacteria
A	chlorination	chlorination
B	chlorination	filtration
C	filtration	chlorination
D	filtration	filtration

30 Which processes do **not** produce carbon dioxide?

1 heating limestone

2 burning gasoline in car engines

3 photosynthesis

4 production of nylon

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

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31 Which pair of compounds would make an NPK fertiliser?

A ammonium sulfate and potassium phosphate

B calcium hydroxide and ammonium nitrate

C calcium phosphate and potassium chloride

D potassium nitrate and ammonium sulfate

32 Which pollutant gas is produced by the decomposition of vegetation?

A carbon monoxide

B methane

C nitrogen dioxide

D sulfur dioxide

33 The equation for the formation of sulfur trioxide from sulfur dioxide is shown.

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

The forward reaction is exothermic.

Which combination of pressure and temperature gives 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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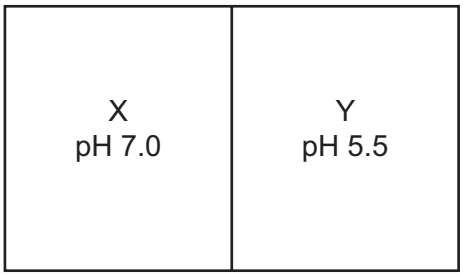
34 The diagram shows the pH values of the soil in two parts of a garden, X and Y.



Lime is used to neutralise the soil in one part of the garden.

To which part of the garden should the lime be added and why?

	part of the garden	because lime is
A	X	acidic
B	X	basic
C	Y	acidic
D	Y	basic

35 Statement 1 Hydrogen is used as a fuel.

Statement 2 When hydrogen burns in the air to form water, heat energy is produced.

Which is correct?

A Both statements are correct and statement 2 explains statement 1.

B Both statements are correct but statement 2 does not explain statement 1.

C Statement 1 is correct but statement 2 is incorrect.

D Statement 2 is correct but statement 1 is incorrect.

36 Which row identifies compounds in the same homologous series?

	chemical properties	functional group
A	different	different
B	different	same
C	similar	different
D	similar	same

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37 Three chemical reactions are shown.

1 catalytic addition of steam to ethene

2 combustion of ethanol

3 fermentation of glucose

In which of the reactions does the relative molecular mass of the carbon-containing compound decrease?

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

38 How is ethanol produced by fermentation?

A using anaerobic conditions at 30 °C

B using anaerobic conditions at 450 °C

C using steam at 30 °C

D using steam at 450 °C

39 Which substances react together to form ethyl propanoate?

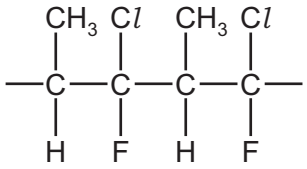
A ethanoic acid and propanol

B ethanol and propene

C ethene and propanol

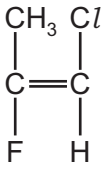
D propanoic acid and ethanol

40 The structure of a chlorofluorocarbon polymer is shown.

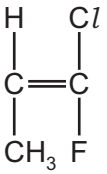


Which monomer is used to make this polymer?

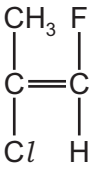
A



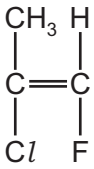
B



C



D



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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.).

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