Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/22**

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)

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.

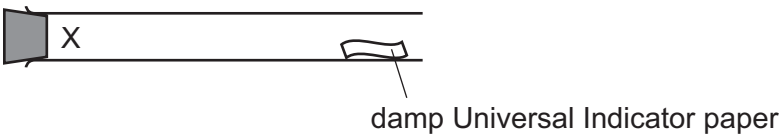
Read the instructions on the Answer Sheet very carefully.

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.

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



Which gas turns the damp Universal Indicator paper red most quickly?

A ammonia, NH_3

B chlorine, Cl_2

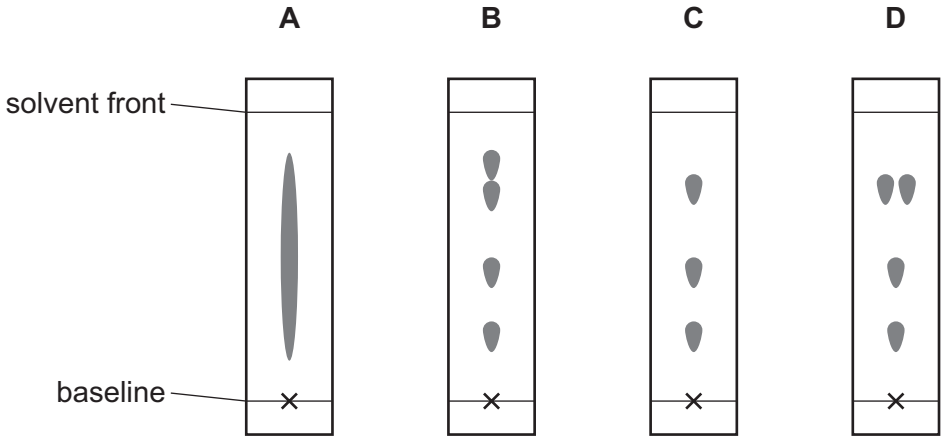
C hydrogen chloride, HCl

D sulfur dioxide, SO_2

2 A chromatography experiment was done to separate a mixture of four substances.

The R_f values measured for these substances were 0.3, 0.5, 0.8 and 0.8.

Which diagram shows the chromatogram obtained?



3 Which piece of apparatus **cannot** be used to collect and measure the volume of gas produced in an experiment?

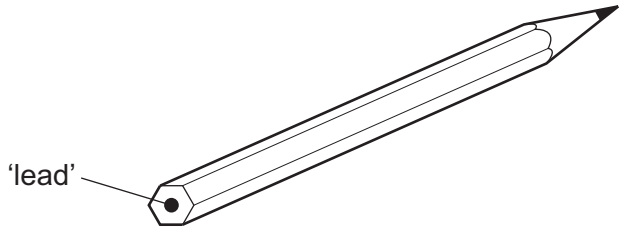
A burette

B gas syringe

C measuring cylinder

D pipette

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.

5 Which pair shows particles with the same chemical properties?

A $^{23}_{11}M$ and $^{23}_{11}M^{+}$

B $^{23}_{11}M$ and $^{24}_{11}M$

C $^{23}_{11}M$ and $^{23}_{12}M$

D $^{24}_{11}M^{+}$ and $^{24}_{12}M^{+}$

6 Which substances have similar structures?

A diamond and graphite

B diamond and silicon(IV) oxide

C graphite and poly(ethene)

D graphite and silicon(IV) oxide

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

A diamond

B graphite

C silicon(IV) oxide

D sulfur

8 The equation for the reaction between potassium carbonate and nitric acid is shown.

$$K_2CO_3 + 2HNO_3 \rightarrow 2KNO_3 + H_2O + CO_2$$

Which volume of carbon dioxide is produced from 69 g of potassium carbonate?

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

9 A solution of sodium carbonate, Na_2CO_3, has a concentration of 0.03 mol / dm^3.

Which mass of sodium carbonate is dissolved in 1 dm^3 of this solution?

A 1.06 g **B** 3.18 g **C** 10.60 g **D** 31.80 g

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

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

A An oxidation reaction occurs at the positive electrode.

B The current is carried through the electrolyte by ions.

C The negative electrode gains mass.

D The number of copper(II) ions in the electrolyte decreases.

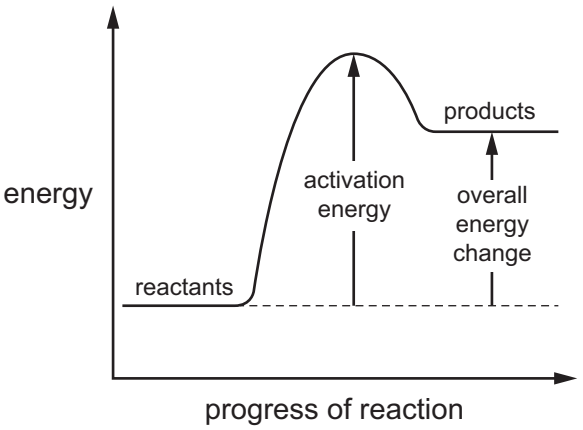
11 Dilute sulfuric acid is electrolysed using inert electrodes.

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 Which diagram is a correctly labelled energy level diagram for an endothermic reaction?

A



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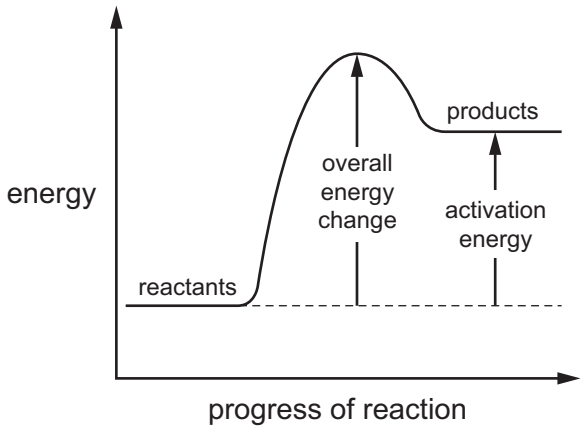

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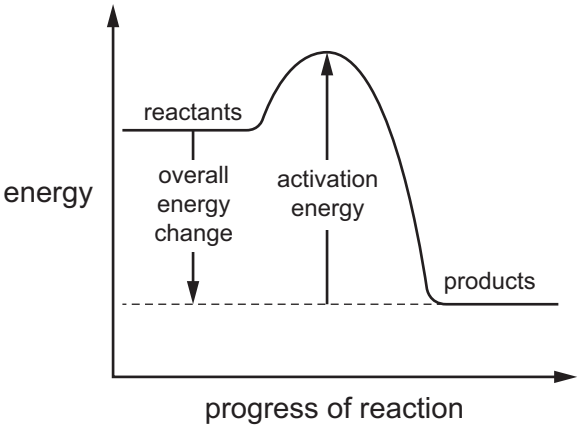

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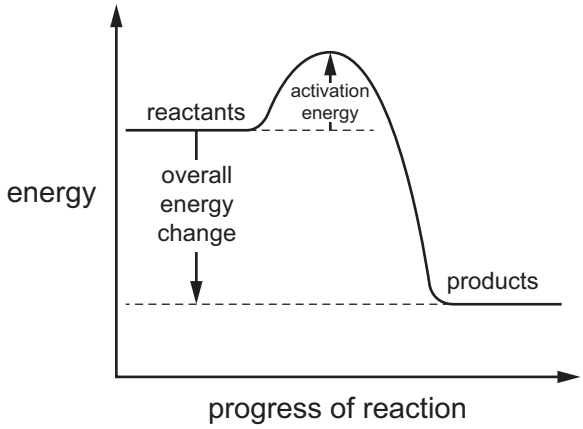


13 The equation for the complete combustion of methane is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

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** –359 kJ / mol **C** –323 kJ / mol **D** +102 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 Sulfur dioxide reacts with oxygen at 2 atmospheres pressure. The forward reaction is exothermic.

The equation for the reaction is shown.

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

The reaction reaches equilibrium. The pressure is then doubled.

How and why does the amount of sulfur trioxide formed change?

	amount of sulfur trioxide	reason
A	decreases	the forward reaction is exothermic
B	decreases	there are fewer molecules on the right
C	increases	the forward reaction is exothermic
D	increases	there are fewer molecules on the right

16 Iron(II) chloride solution reacts with chlorine gas.

The equation is shown.

$$2FeCl_2(aq) + Cl_2(g) \rightarrow 2FeCl_3(aq)$$

Which statements about this reaction are correct?

1 Fe^{2+} ions are reduced to Fe^{3+} ions.

2 Chlorine acts as a reducing agent.

3 Fe^{2+} ions each lose an electron.

4 Cl_2 molecules are reduced to Cl^- ions.

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

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 statement about acids and bases is correct?

A A base is a donor of hydrogen ions.

B An acid is an acceptor of protons.

C A strong acid is fully ionised in aqueous solution.

D A weak acid cannot be used to neutralise a strong base.

19 The solubility of some salts is shown.

	chloride	nitrate	sulfate	carbonate
barium	soluble	soluble	insoluble	insoluble
lead(II)	insoluble	soluble	insoluble	insoluble
potassium	soluble	soluble	soluble	soluble
zinc	soluble	soluble	soluble	insoluble

Which two aqueous solutions produce an insoluble salt when mixed together?

A barium chloride and zinc nitrate

B barium nitrate and lead(II) nitrate

C lead(II) nitrate and potassium carbonate

D potassium nitrate and zinc sulfate

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 statement about the Periodic Table is correct?

A Elements in the same group have the same number of electron shells.

B It contains elements arranged in order of increasing proton number.

C Metals are on the right and non-metals are on the left.

D The most reactive elements are at the bottom of every group.

22 Chlorine, bromine and iodine are elements in Group VII of the Periodic Table.

Which statement about these elements is **not** correct?

A The colour gets darker down the group.

B The density increases down the group.

C They are all gases at room temperature and pressure.

D They are all non-metals.

23 Which row describes the properties of a transition element?

	property 1	property 2
A	forms colourless compounds	acts as a catalyst
B	forms colourless compounds	low electrical conductivity
C	high density	acts as a catalyst
D	high density	low electrical conductivity

24 Stainless steel is an alloy of iron, carbon and other metals.

Which row is correct?

	stainless steel is harder than pure iron	stainless steel resists corrosion better than pure iron
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

25 Metal X is more reactive than metal Y. Metal Y is more reactive than metal Z.

Which statement is correct?

A When metal X is placed in a solution of Y sulfate, there is no reaction.

B When metal X is placed in a solution of Z sulfate, a reaction occurs.

C When metal Y is placed in a solution of Z sulfate, there is no reaction.

D When metal Z is placed in a solution of X sulfate, a reaction occurs.

26 Which statement about the industrial extraction of zinc is correct?

A Cryolite is added to lower the melting point.

B Molten zinc oxide is electrolysed.

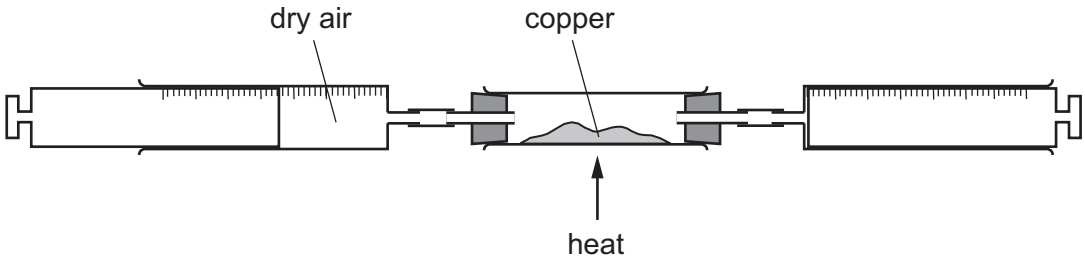
C Zinc oxide is heated with coke.

D Zinc sulfide is heated with coke.

27 Which row describes the use of an alloy and the property upon which the use depends?

	alloy	use	property
A	mild steel	cutlery	resistant to corrosion
B	mild steel	machinery	strong
C	stainless steel	cutlery	low density
D	stainless steel	machinery	good conductor of electricity

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 / °C	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

33 Which row describes the uses of sulfur and sulfur dioxide?

	sulfur	sulfur dioxide
A	extraction of aluminium	food preservative
B	extraction of aluminium	water treatment
C	manufacture of sulfuric acid	food preservative
D	manufacture of sulfuric acid	water treatment

34 Limestone is used in many industrial processes.

In which process is it **not** used?

A manufacture of alkenes

B manufacture of cement

C manufacture of iron

D manufacture of lime

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 statement about alkenes is **not** correct?

A They decolourise aqueous bromine.

B They only contain the elements carbon and hydrogen.

C They react with hydrogen to form alkanes.

D They react with steam to produce carboxylic acids.

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)

[Turn over

38 Two processes used for the large-scale production of ethanol are shown.

process 1 A compound containing carbon, hydrogen and oxygen is used to produce ethanol.

process 2 A compound containing carbon and hydrogen only is used to produce ethanol.

Which statement is correct?

A Process 1 uses a renewable starting material.

B Process 1 is done at a very high temperature.

C Process 2 involves fermentation.

D Process 2 is done at room temperature.

39 What is the name of the organic product of the reaction shown?

$$CH_3COOH + CH_3CH_2OH \rightarrow$$

A ethyl ethanoate

B ethyl methanoate

C methyl ethanoate

D methyl propanoate

40 Which two compounds react together to form a condensation polymer?

A $HOCH_2CH_2OH$ and CH_3COOH

B $HOCH_2CH_2OH$ and CH_3NH_2

C $HOCH_2CH_2OH$ and $H_2NCH_2CH_2NH_2$

D $HOCH_2CH_2OH$ and $HOOCCH_2CH_2COOH$

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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.).