Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/23**

Paper 2 Multiple Choice (Extended) **October/November 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 **15** printed pages and **1** blank page.

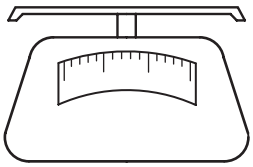
1 Gases are separated from liquid air by fractional distillation. The boiling points of four gases are shown.

Which gas is both monatomic and a liquid at –200 °C?

	gas	boiling point / °C
A	argon	–186
B	helium	–269
C	neon	–246
D	nitrogen	–196

2 The diagrams show four pieces of laboratory equipment.

balance



pipette

stop-clock

thermometer

Which equipment is essential to find out if dissolving a salt in water is an exothermic process?

	balance	pipette	stop-clock	thermometer
A	✗	✗	✗	✓
B	✓	✗	✗	✓
C	✗	✓	✗	✓
D	✓	✗	✓	✗

3 Which statement describes isotopes?

A Isotopes of the same element have different electron arrangements.

B Isotopes of the same element have different nuclear charges.

C Isotopes of the same element have nuclei with masses that are the same.

D Isotopes of the same element have the same number of protons.

4 X and Y are both atoms.

X and Y have the same chemical properties as each other.

Which row describes the atomic structures of X and Y?

	X			Y		
	protons	neutrons	electrons	protons	neutrons	electrons
A	6	6	6	6	6	7
B	6	6	6	6	8	6
C	6	6	6	16	16	16
D	7	6	7	6	6	7

5 Which covalent molecule contains two atoms bonded together by exactly four shared electrons?

A N_2 **B** C_3H_8 **C** CH_3OH **D** CH_3COOH

6 The formula of ammonia is NH_3.

Which statement about a molecule of ammonia is correct?

A The bonding in a molecule of ammonia is ionic.

B The nitrogen atom has a noble gas configuration, the hydrogen atoms do not.

C The nitrogen atom shares all of its electrons with hydrogen atoms.

D There are six shared electrons in a molecule of ammonia.

7 Which gas sample has the greatest mass?

A 5.0 moles of Cl_2

B 10.0 moles of O_2

C 15.0 moles of N_2

D 20.0 moles of H_2

8 Which sample of magnesium chloride, $MgCl_2$, contains the same number of moles as 69.6 g of potassium sulfate, K_2SO_4?

A 19.0 g **B** 28.5 g **C** 38.0 g **D** 47.5 g

9 Iron(III) chromate is a yellow solid. It contains the ions Fe^{3+} and CrO_4^{2-}.

What is the formula of iron(III) chromate?

A $FeCrO_4$ **B** $Fe_3(CrO_4)_2$ **C** Fe_2CrO_4 **D** $Fe_2(CrO_4)_3$

10 Electrolysis of copper(II) sulfate can be done using either carbon electrodes or copper electrodes.

Which statement describes what happens at the positive electrode?

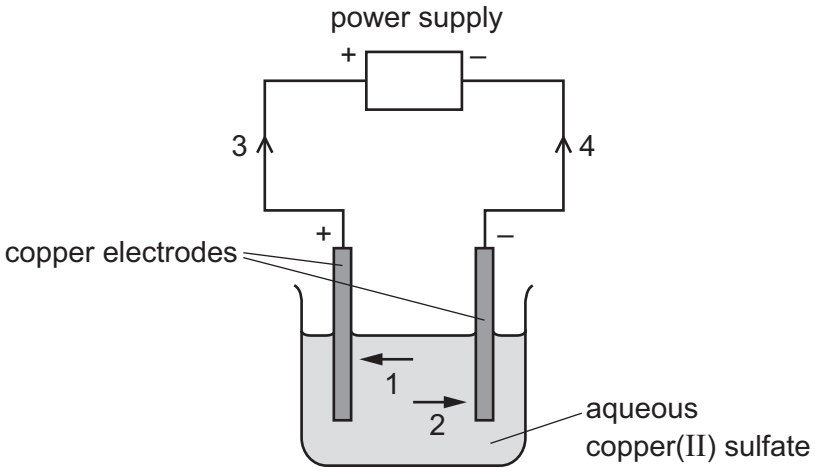
A Copper is deposited if the electrode is made from carbon.

B Copper is deposited if the electrode is made from copper.

C Oxygen gas is produced if the electrode is made from carbon.

D Oxygen gas is produced if the electrode is made from copper.

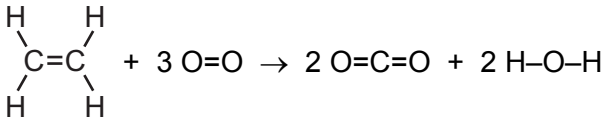
11 The diagram shows a circuit used to electrolyse aqueous copper(II) sulfate.



Which arrows indicate the movement of the copper ions in the electrolyte and of the electrons in the external circuit?

	copper ions	electrons
A	1	3
B	1	4
C	2	3
D	2	4

12 Ethene burns in oxygen to form carbon dioxide and water vapour.



The bond energies are shown in the table.

bond	bond energy in kJ / mol
C=C	+610
C–H	+410
O=O	+497
C=O	+805
O–H	+460

What is the energy change for the reaction?

A –2959 kJ / mol

B –2313 kJ / mol

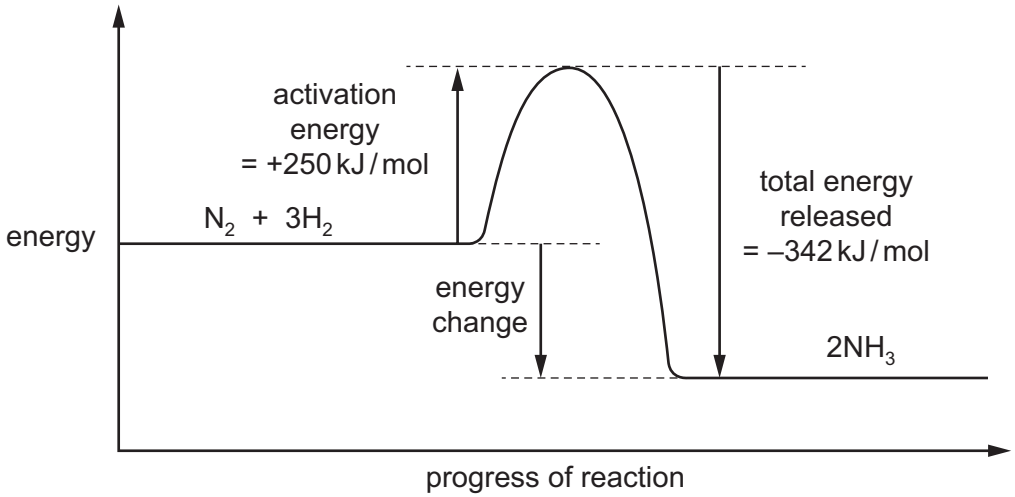
C –1319 kJ / mol

D –399 kJ / mol

13 The equation for the formation of ammonia is shown.

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

The energy level diagram for the reaction is shown.



What is the energy change for the reaction?

A –592 kJ / mol

B –92 kJ / mol

C +92 kJ / mol

D +592 kJ / mol

14 Dilute hydrochloric acid reacts with 1 g of limestone.

Which conditions produce the fastest rate of reaction?

A 2 mol / dm^3 hydrochloric acid and a single lump of limestone

B 4 mol / dm^3 hydrochloric acid and a single lump of limestone

C 4 mol / dm^3 hydrochloric acid and small pieces of limestone

D 4 mol / dm^3 hydrochloric acid and powdered limestone

15 The reversible reaction between methane and steam is shown.

$$CH_4(g) + H_2O(g) \rightleftharpoons CO(g) + 3H_2(g)$$

The forward reaction is endothermic.

Which changes in pressure and temperature move the equilibrium to the right?

	pressure	temperature
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

16 The equation for the reaction between zinc and copper(II) oxide is shown.

$$Zn + CuO \rightarrow ZnO + Cu$$

Which row shows the oxidising agent and the reducing agent?

	oxidising agent	reducing agent
A	CuO	Cu
B	CuO	Zn
C	Zn	CuO
D	Zn	ZnO

17 The results of some experiments with sulfur dioxide are shown.

experiment	description	result
1	mix with dilute hydrochloric acid	does not react
2	mix with concentrated sodium hydroxide	a salt forms
3	add Universal Indicator	Universal Indicator turns purple
4	add acidified aqueous potassium manganate(VII)	purple solution turns colourless

Which results are correct?

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

18 A white precipitate is produced when small amounts of two colourless solutions are mixed together.

Which pairs of solutions produce a white precipitate?

1 sodium hydroxide and zinc nitrate

2 sodium hydroxide and aluminium chloride

3 barium chloride and sulfuric acid

4 acidified barium nitrate and potassium sulfate

A 1, 2, 3 and 4

B 1, 2 and 4 only

C 1 and 2 only

D 2 only

19 Solution Q is warmed with ammonium chloride.

In a separate experiment, solution Q is added to methyl orange.

Which observations show that solution Q is basic?

	warmed with ammonium chloride	added to methyl orange
A	gas is produced	turns red
B	gas is produced	turns yellow
C	no reaction	turns red
D	no reaction	turns yellow

20 Some general rules for the solubility of salts in water are listed.

- Carbonates are insoluble (except ammonium carbonate, potassium carbonate and sodium carbonate).
- Chlorides are soluble (except lead(II) chloride and silver chloride).
- Nitrates are soluble.
- Sulfates are soluble (except barium sulfate, calcium sulfate and lead(II) sulfate).

Which substances produce an insoluble salt when aqueous solutions of them are mixed?

A barium chloride and magnesium nitrate

B calcium chloride and ammonium nitrate

C silver nitrate and zinc chloride

D sodium carbonate and potassium sulfate

21 Elements in Group I of the Periodic Table react with water.

Which row describes the products made in the reaction and the trend in reactivity of the elements?

	products	trend in reactivity
A	metal hydroxide and hydrogen	less reactive down the group
B	metal hydroxide and hydrogen	more reactive down the group
C	metal oxide and hydrogen	less reactive down the group
D	metal oxide and hydrogen	more reactive down the group

22 The equation shows the reaction between a halogen and aqueous bromide ions.

$$X_2 + 2Br^- \rightarrow 2X^- + Br_2$$

.....1..... .....2..... .....3.....

Which words complete gaps 1, 2 and 3?

	1	2	3
A	chlorine	brown	colourless
B	chlorine	colourless	brown
C	iodine	brown	colourless
D	iodine	colourless	brown

23 An inert gas R is used to fill weather balloons.

Which descriptions of R are correct?

	number of outer shell electrons in atoms of R	structure of gas R
A	2	diatomic molecules
B	2	single atoms
C	8	diatomic molecules
D	8	single atoms

24 Heating copper(II) carbonate produces copper(II) oxide and carbon dioxide.

Heating the copper(II) oxide formed with carbon produces copper.

Which colour changes are observed during these reactions?

A green → black → brown

B green → white → brown

C blue → black → silver

D blue → white → brown

25 Calcium reacts with cold water to produce hydrogen.

Lead reacts slowly when heated in air to form an oxide but has almost no reaction with steam.

Silver does not react with either air or water.

Zinc reacts when heated with steam to produce hydrogen.

What is the order of reactivity starting with the least reactive?

	least reactive ⟶ most reactive			
A	calcium	lead	zinc	silver
B	calcium	zinc	lead	silver
C	silver	lead	zinc	calcium
D	silver	zinc	lead	calcium

26 Which row describes the use of a metal and the property upon which the use depends?

	metal	use	property
A	aluminium	aircraft bodies	aluminium is a heat conductor
B	aluminium	cooking utensils	aluminium has a low density
C	copper	cooking utensils	copper has a high density
D	copper	electrical wiring	copper is a good conductor of electricity

27 Which statement about the manufacture of aluminium by electrolysis is correct?

A Aluminium ions are oxidised to aluminium by gaining electrons.

B Aluminium is extracted from its ore hematite.

C Molten cryolite is used to dissolve the aluminium oxide.

D Oxygen is formed at the negative electrode.

28 Ammonia is manufactured by the Haber process from nitrogen and hydrogen.

Which row gives the main sources of these two gases?

	hydrogen	nitrogen
A	air	air
B	air	natural gas
C	natural gas	air
D	natural gas	natural gas

29 Which equation represents the incomplete combustion of propane, C_3H_8?

A $2C_3H_8 + 7O_2 \rightarrow 6CO + 8H_2O$

B $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

C $2C_3H_8 + 11O_2 \rightarrow 6CO + 16H_2O$

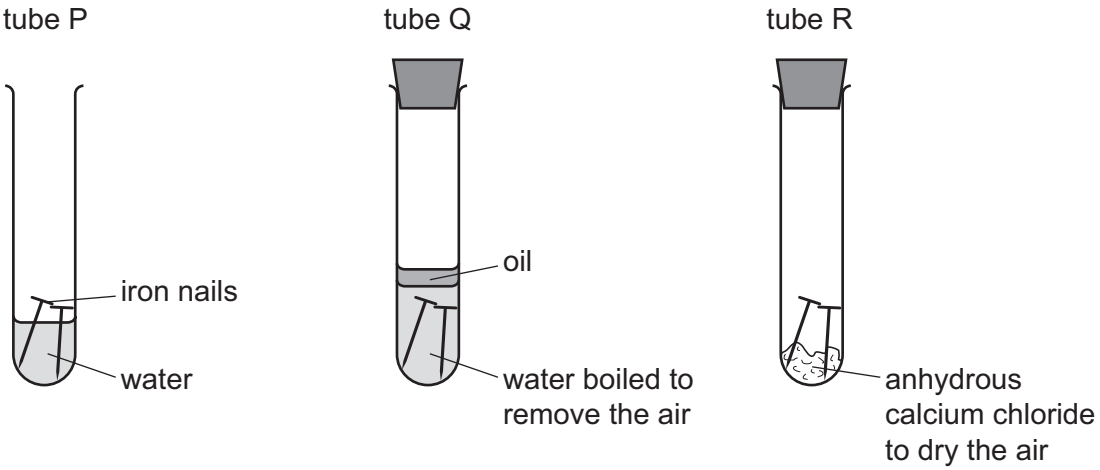
D $C_3H_8 + 7O_2 \rightarrow 3CO_2 + 8H_2O$

30 Argon is a noble gas used to fill light bulbs.

What is the approximate percentage of argon in air?

A 1% **B** 20% **C** 79% **D** 99%

31 The diagrams show experiments involving the rusting of iron.



A student predicted the following results.

1 In tube P, the iron nails rust.

2 In tube Q, the iron nails do not rust.

3 In tube R, the iron nails do not rust.

Which predictions are correct?

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

32 Which statement about the carbon cycle is correct?

A Animals and plants need carbon dioxide for respiration.

B Combustion of plants and natural gas produces carbon dioxide.

C Plants produce glucose from carbon dioxide and oxygen.

D Oxygen is produced by both animals and plants.

33 Which statement about sulfur or one of its compounds is correct?

A Sulfur occurs naturally as the element sulfur.

B Sulfur dioxide is used to kill bacteria in drinking water.

C Sulfuric acid is a weak acid.

D Dilute sulfuric acid is a dehydrating agent.

34 Which equation represents the formation of lime?

A $CaCO_3 \rightarrow CaO + CO_2$

B $CaO + H_2O \rightarrow Ca(OH)_2$

C $Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$

D $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

35 Which equation representing a reaction of methane is correct?

A $CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$

B $CH_4 + Cl_2 \rightarrow CH_4Cl_2$

C $CH_4 + Cl_2 \rightarrow CH_2Cl_2 + H_2$

D $2CH_4 + 2Cl_2 \rightarrow 2CH_3Cl + Cl_2 + H_2$

36 Which two compounds are molecules which both contain a double bond?

A ethane and ethanoic acid

B ethane and ethanol

C ethene and ethanoic acid

D ethene and ethanol

37 Ethanol can be formed by:

1 fermentation

2 reaction between steam and ethene.

Which of these processes use a catalyst?

	1	2
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

38 Sugar can be fermented to produce ethanol.

Some of the stages in the process to produce and purify ethanol are listed.

1 Leave in a warm place.

2 Add yeast.

3 Fractionally distil the solution.

4 Dissolve the sugar in water.

5 Filter to remove the yeast.

6 Crush some sugar cane.

What is the correct order of these stages?

A $4 \rightarrow 6 \rightarrow 2 \rightarrow 1 \rightarrow 5 \rightarrow 3$

B $6 \rightarrow 4 \rightarrow 1 \rightarrow 2 \rightarrow 5 \rightarrow 3$

C $6 \rightarrow 4 \rightarrow 2 \rightarrow 1 \rightarrow 3 \rightarrow 5$

D $6 \rightarrow 4 \rightarrow 2 \rightarrow 1 \rightarrow 5 \rightarrow 3$

39 Which statement about ethanoic acid is correct?

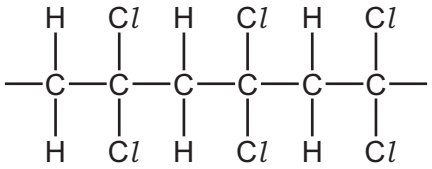
A It contains a $-C_2H_5$ group.

B It is a strong acid.

C It is formed by the reduction of ethanol.

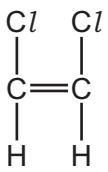
D It reacts with alcohols to form esters.

40 The structure of a polymer is shown.

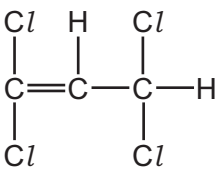


Which monomer is used to make this polymer?

A



B



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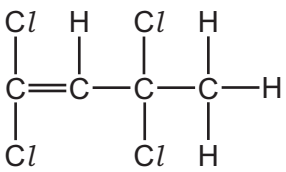
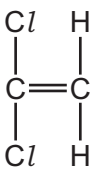


D



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The Periodic Table of Elements

Group I	Group II											Group III	Group IV	Group V	Group VI	Group VII	Group 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.).