Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CHEMISTRY **0620/23**

Paper 2 Multiple Choice (Extended) **October/November 2017**

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 Which statement describes sublimation?

A Particles moving slowly past each other speed up and move further apart.

B Particles vibrating next to each other become mobile and move slowly past each other.

C Particles vibrating next to each other start to move rapidly and move further apart.

D Rapidly moving particles slow down and move closer together.

2 25 cm^3 of an alkali are added to 20 cm^3 of an acid. The temperature change is measured.

Which apparatus is **not** needed in the experiment?

A 25 cm^3 measuring cylinder

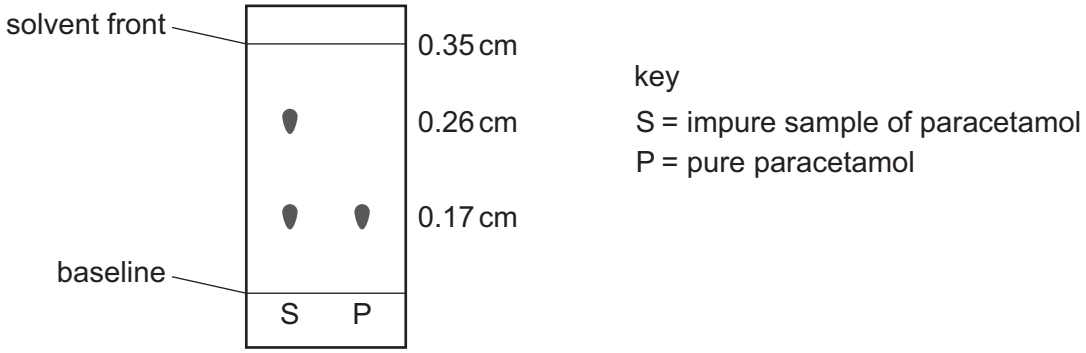
B 100 cm^3 beaker

C balance

D thermometer

3 The painkiller paracetamol is synthesised from 4-aminophenol.

Chromatography was carried out on an impure sample of paracetamol. The results are shown (not drawn to scale).



The sample of paracetamol was contaminated with 4-aminophenol only.

What is the R_f value of 4-aminophenol?

A 0.49 **B** 0.65 **C** 0.74 **D** 1.35

4 Which compound is silicon(IV) oxide?

	melting point / °C	good electrical conductor when solid	good electrical conductor when molten
A	–73	no	no
B	801	no	yes
C	1495	yes	yes
D	1710	no	no

5 Carbon has three naturally occurring isotopes, ^{12}C, ^{13}C and ^{14}C.

Which statement explains why the isotopes have the same chemical properties?

A They have the same number of electrons in the first shell.

B They have the same number of electrons in the outer shell.

C They have the same number of neutrons in the nucleus.

D They have the same number of protons as neutrons.

6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of carbon dioxide?

A

B

C

D

7 The equation represents the reaction between solid magnesium oxide and dilute hydrochloric acid to form magnesium chloride and water.

$$MgO + 2HCl \rightarrow MgCl_2 + H_2O$$

Which row shows the state symbols for hydrochloric acid, magnesium chloride and water?

	HCl	$MgCl_2$	H_2O
A	(aq)	(aq)	(l)
B	(aq)	(l)	(l)
C	(l)	(aq)	(aq)
D	(l)	(l)	(aq)

8 A compound contains 34.5% calcium, 24.1% silicon and 41.4% oxygen by mass.

What is its empirical formula?

A Ca_2SiO_3 **B** $CaSiO_3$ **C** $CaSi_2O_3$ **D** $CaSiO_6$

9 Which statements about the electrolysis of concentrated copper(II) chloride are correct?

1 Electrons are transferred from the cathode to the copper(II) ions.

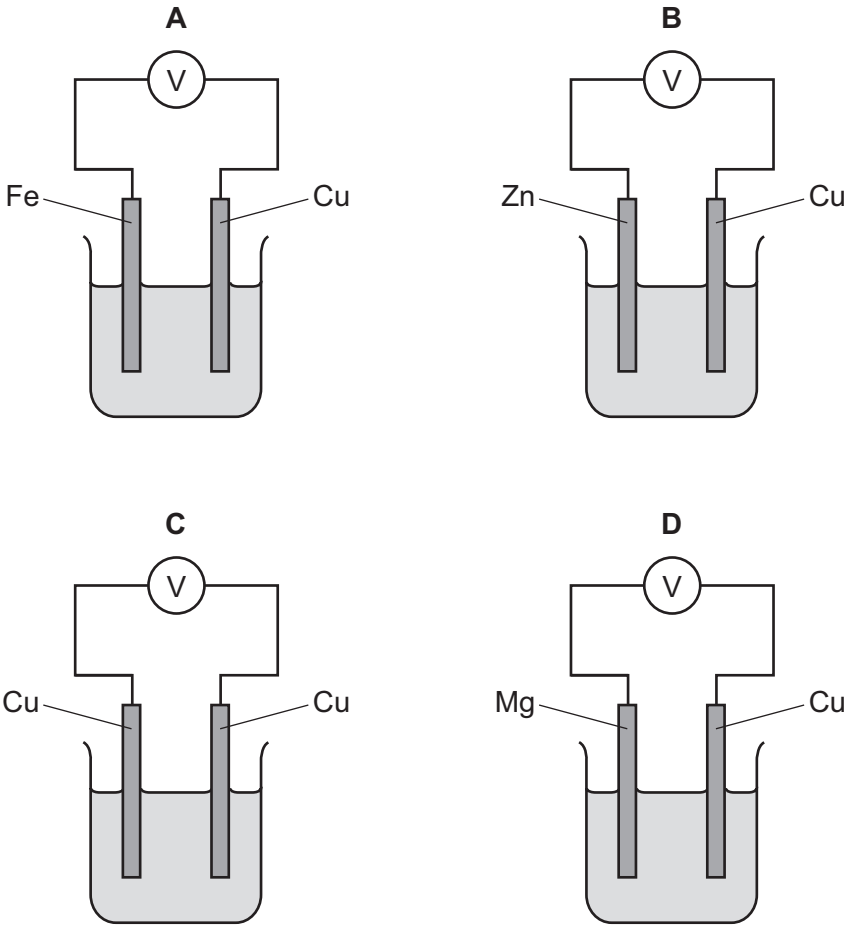
2 Electrons move round the external circuit from the cathode to the anode.

3 Chloride ions are attracted to the anode.

4 Hydroxide ions transfer electrons to the cathode.

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

10 Which metal combination produces the highest voltage reading in the cells shown?



11 Some bond energies are shown in the table.

bond	bond energy in kJ / mol
H–H	+436
O=O	+496
H–O	+460

Hydrogen reacts with oxygen. The reaction is exothermic.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

What is the energy change for the reaction?

A –3208 kJ / mol

B –908 kJ / mol

C –472 kJ / mol

D –448 kJ / mol

12 Which statement describes an exothermic reaction?

A The energy absorbed for bond breaking is greater than the energy released by bond formation.

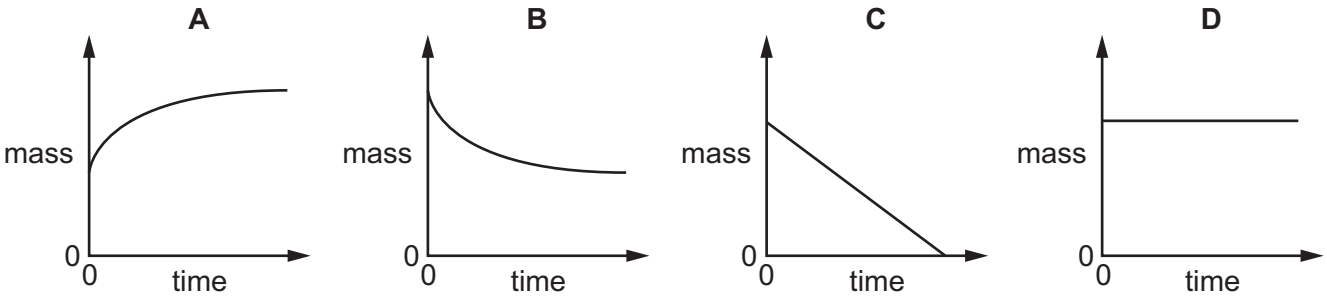
B The energy absorbed for bond breaking is less than the energy released by bond formation.

C The energy released by bond breaking is greater than the energy absorbed for bond formation.

D The energy released by bond breaking is less than the energy absorbed for bond formation.

13 The mass of a beaker and its contents is plotted against time.

Which graph represents what happens when sodium carbonate reacts with an excess of dilute hydrochloric acid in an open beaker?



14 Silver chloride reacts when it is exposed to light.

Which row shows what happens to the silver in this process?

	half-equation	type of reaction
A	$Ag \rightarrow Ag^+ + e^-$	oxidation
B	$Ag \rightarrow Ag^+ + e^-$	reduction
C	$Ag^+ + e^- \rightarrow Ag$	oxidation
D	$Ag^+ + e^- \rightarrow Ag$	reduction

15 Which statement about the effect of concentration and temperature on the rate of a reaction is **not** correct?

A If the concentration of a reactant is increased, the rate of reaction increases because more particles have sufficient energy to react.

B If the concentration of a reactant is increased, the rate of reaction increases because there are more collisions between particles per second.

C If the temperature is increased, the rate of reaction increases because there are more collisions between particles per second.

D If the temperature is increased, the rate of reaction increases because more particles have sufficient energy to react.

16 The following reaction has reached equilibrium in a closed system.

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

The forward reaction is exothermic.

Which row shows the effect of increasing the pressure on the equilibrium mixture?

	reaction rate	amount of SO_2	amount of SO_3
A	increases	decreases	increases
B	increases	increases	decreases
C	unchanged	decreases	increases
D	unchanged	increases	decreases

17 Some properties of four oxides are listed.

Oxide 1 reacts with both acids and alkalis to form salts.

Oxide 2 reacts with acids to form salts but does not react with alkalis.

Oxide 3 reacts with alkalis to form salts but does not react with acids.

Oxide 4 does not react with acids or alkalis.

Which row describes the oxides?

	oxide 1	oxide 2	oxide 3	oxide 4
A	amphoteric	acidic	basic	neutral
B	amphoteric	basic	acidic	neutral
C	neutral	acidic	basic	amphoteric
D	neutral	basic	acidic	amphoteric

18 What is **not** a typical characteristic of acids?

A They react with alkalis producing water.

B They react with **all** metals producing hydrogen.

C They react with carbonates producing carbon dioxide.

D They turn blue litmus paper red.

19 Three solids, P, Q and R, all react with dilute sulfuric acid to produce zinc sulfate.

P and R produce gases during the reaction.

The gas produced when P reacts will not burn. The gas produced when R reacts will burn.

What are P, Q and R?

	P	Q	R
A	zinc	zinc hydroxide	zinc carbonate
B	zinc carbonate	zinc	zinc oxide
C	zinc carbonate	zinc hydroxide	zinc
D	zinc oxide	zinc carbonate	zinc

20 Which ion forms a green precipitate with aqueous sodium hydroxide that dissolves in an excess of aqueous sodium hydroxide?

A Ca^{2+} **B** Cr^{3+} **C** Cu^{2+} **D** Fe^{2+}

[Turn over

21 A period of the Periodic Table is shown.

group	I	II	III	IV	V	VI	VII	VIII
element	R	S	T	V	W	X	Y	Z

The letters are not their chemical symbols.

Which statement is correct?

A Element R does not conduct electricity.

B Elements R and Y react together to form an ionic compound.

C Element Z exists as a diatomic molecule.

D Element Z reacts with element T.

22 Some properties of element X are shown.

melting point in °C	98
boiling point in °C	883
reaction with cold water	gives off H_2 gas
reaction when heated with oxygen	burns to give a white solid

In which part of the Periodic Table is X found?

A Group I

B Group VII

C Group VIII

D transition elements

23 The table gives some properties of an element.

melting point in °C	3422
appearance of the element	grey
appearance of the chloride of the element	dark blue
density in g / cm^3	19.2
electrical conductivity when solid	good

Which other property would you expect this element to have?

A acts as a catalyst

B brittle

C forms an acidic oxide

D highly reactive with water

24 Why is argon gas used to fill electric lamps?

A It conducts electricity.

B It glows when heated.

C It is less dense than air.

D It is not reactive.

25 What is a property of **all** metals?

A conduct electricity

B hard

C low melting points

D react with water

26 Aluminium is obtained by the electrolysis of a mixture of aluminium oxide and cryolite.

Why is cryolite used?

A as a catalyst to speed up the process

B as a coolant to prevent the process getting too hot

C as a solvent for aluminium oxide

D as the main source of aluminium ions

[Turn over

27 Metal M is mixed with copper to produce brass.

What is M?

A chromium

B nickel

C vanadium

D zinc

28 Some metal nitrates and carbonates decompose when heated strongly.

Metal Q has a nitrate that decomposes to give a salt and a colourless gas only.

The carbonate of metal Q does not decompose when heated with a Bunsen burner.

What is metal Q?

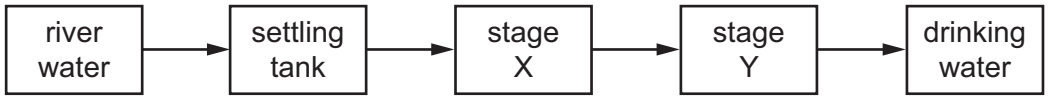
A calcium

B copper

C sodium

D zinc

29 The flow chart shows stages in the treatment of river water to produce drinking water.



What occurs at stages X and Y?

	X	Y
A	distillation	chlorination
B	distillation	filtration
C	filtration	chlorination
D	filtration	distillation

30 A piece of zinc is attached to the hull of a steel boat. Steel is an alloy of iron.

Which statement explains why the zinc prevents the iron from rusting?

A Zinc is less reactive than iron, and iron is less likely to lose electrons than zinc.

B Zinc is less reactive than iron, and iron is more likely to lose electrons than zinc.

C Zinc is more reactive than iron, and iron is less likely to lose electrons than zinc.

D Zinc is more reactive than iron, and iron is more likely to lose electrons than zinc.

31 The Haber process for making ammonia is carried out at a temperature of 450 °C and a pressure of 200 atmospheres in the presence of a catalyst.

Which statement is **not** correct?

A Lowering the pressure increases the rate at which ammonia is produced.

B Lowering the temperature slows down the rate at which ammonia is produced.

C Maintaining a very high pressure is very difficult and needs expensive equipment.

D The reaction is a reversible reaction which can proceed forwards and backwards.

32 Which process does **not** produce carbon dioxide?

A combustion of methane

B photosynthesis

C respiration

D thermal decomposition of calcium carbonate

33 Which row shows the conditions used in the manufacture of sulfuric acid by the Contact process?

	temperature / °C	pressure / atm	catalyst
A	40	200	Fe
B	40	200	V_2O_5
C	400	2	Fe
D	400	2	V_2O_5

[Turn over

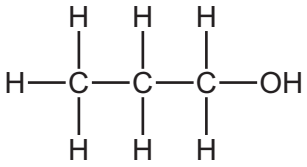
34 Some marble chips (calcium carbonate) are heated strongly and substances X and Y are formed.

Substance X is a white solid that reacts with water, giving out heat. Substance Y is a colourless gas.

What are substances X and Y?

	X	Y
A	calcium chloride	oxygen
B	calcium hydroxide	carbon dioxide
C	calcium oxide	carbon dioxide
D	calcium sulfate	oxygen

35 The structure of compound R is shown.



What is R?

A propane

B propanoic acid

C propanol

D propene

36 Fuel oil and naphtha are two fractions obtained from petroleum.

What are the major uses of these fractions?

	fuel oil	naphtha
A	jet fuel	making chemicals
B	jet fuel	making roads
C	ship fuel	making chemicals
D	ship fuel	making roads

37 X, Y and Z are three hydrocarbons.

X $CH_2=CH_2$ Y $CH_3–CH=CH_2$ Z $CH_3–CH_2–CH=CH_2$

What do compounds X, Y and Z have in common?

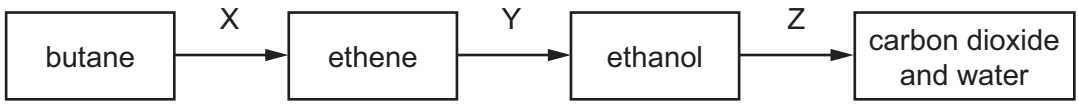
1 They are all alkenes.

2 They are all part of the same homologous series.

3 They all have the same boiling point.

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

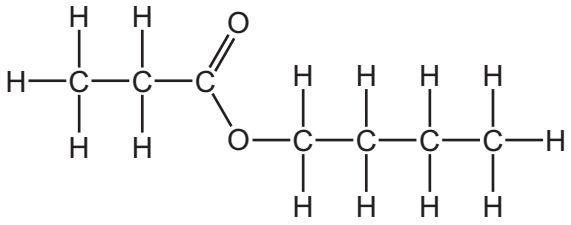
38 The diagram shows a reaction sequence.



Which row names the processes X, Y and Z?

	X	Y	Z
A	cracking	fermentation	respiration
B	cracking	hydration	combustion
C	distillation	fermentation	respiration
D	distillation	hydration	combustion

39 The structure of an ester is shown.

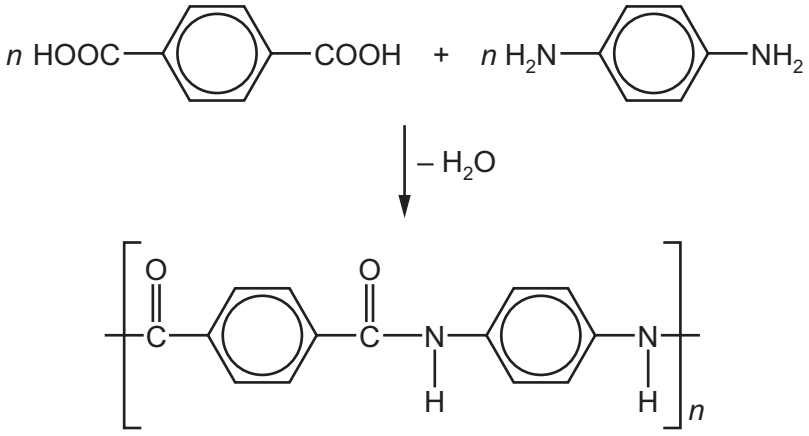


Which combination of carboxylic acid and alcohol produces this ester?

	carboxylic acid	alcohol
A	butanoic acid	ethanol
B	butanoic acid	propanol
C	ethanoic acid	butanol
D	propanoic acid	butanol

[Turn over

40 The equation shows the formation of a polymer called *Kevlar*.



Which row describes *Kevlar*?

	how the polymer is formed	type of polymer
A	addition polymerisation	polyamide
B	addition polymerisation	polyester
C	condensation polymerisation	polyamide
D	condensation polymerisation	polyester

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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.).