Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/23**

Paper 2 Multiple Choice (Extended) **May/June 2021**

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

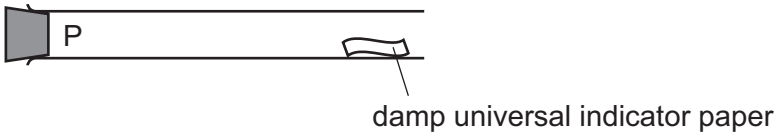
INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

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1 A gas is released at point P 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 1 cm^3 sample of substance X is taken. This is sample 1.

X is then converted to a different physical state and a 1 cm^3 sample is taken. This is sample 2.

Sample 2 contains more particles in the 1 cm^3 than sample 1.

Which process caused this increase in the number of particles in 1 cm^3?

A boiling of liquid X

B condensation of gaseous X

C evaporation of liquid X

D sublimation of solid X

3 Which statement about paper chromatography is correct?

A A solvent is needed to dissolve the paper.

B Paper chromatography separates mixtures of solvents.

C The solvent should cover the baseline.

D The baseline should be drawn in pencil.

4 Element X has 7 protons.

Element Y has 8 more protons than X.

Which statement about element Y is correct?

A Y has more electron shells than X.

B Y has more electrons in its outer shell than X.

C Y is in a different group of the Periodic Table from X.

D Y is in the same period of the Periodic Table as X.

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5 A covalent molecule Q contains only six shared electrons.

What is Q?

A ammonia, NH_3

B chlorine, Cl_2

C methane, CH_4

D water, H_2O

6 Which statement explains why metals are malleable?

A The atoms release electrons to become cations.

B The electrons are free to move.

C The electrons and the cations are attracted to each other.

D The layers of ions can slide over each other.

7 Which statement about isotopes of the same element is correct?

A They have different numbers of electrons.

B They have different numbers of neutrons.

C They have different numbers of protons.

D They have the same mass number.

8 The element silicon has the same structure as diamond.

Which statement about silicon is correct?

A Every silicon atom is bonded to three other atoms only.

B Silicon has a high melting point.

C Silicon is a good conductor of electricity.

D Silicon is used as a lubricant.

9 Three ionic compounds of vanadium have the formulae V_2O, VCl_2 and V_2O_3.

What is the charge on the vanadium ion in each compound?

	V_2O	VCl_2	V_2O_3
A	+1	–2	+2
B	+1	+2	+3
C	+2	–2	+2
D	+2	+2	+3

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10 In separate experiments, electricity was passed through concentrated aqueous sodium chloride and molten lead(II) bromide.

What would happen in **both** experiments?

A A halogen would be formed at the anode.

B A metal would be formed at the cathode.

C Hydrogen would be formed at the anode.

D Hydrogen would be formed at the cathode.

11 The equation for the decomposition of calcium carbonate is shown.

$$CaCO_3 \rightarrow CaO + CO_2$$

What mass of calcium oxide is produced when 10 g of calcium carbonate is heated?

A 4.4 g **B** 5.0 g **C** 5.6 g **D** 10.0 g

12 Gas syringe X contains 100 cm^3 of hydrogen bromide gas, HBr.

Gas syringe Y contains 100 cm^3 of carbon dioxide gas. The volume of each gas is measured at room temperature and pressure.

Which statement is correct?

A The mass of HBr is less than the mass of CO_2.

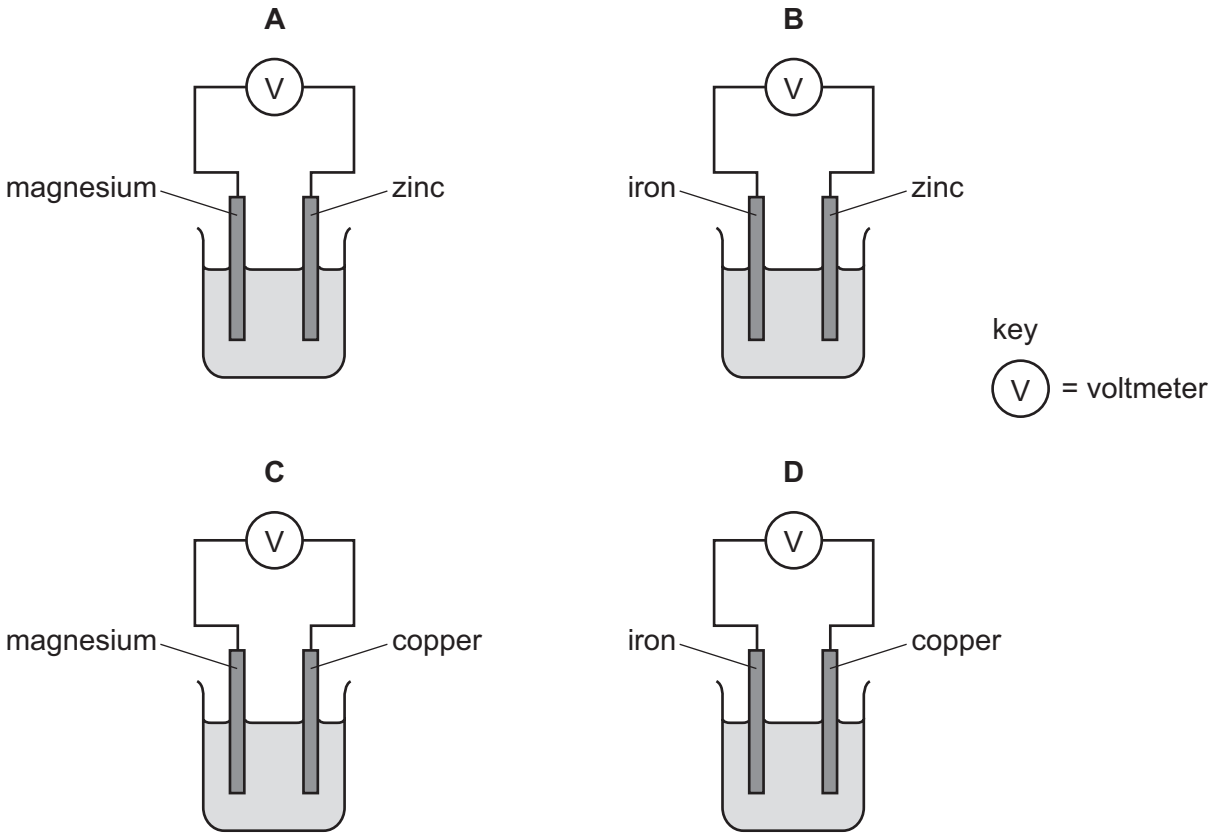
B The number of molecules of HBr equals the number of molecules of CO_2.

C The gas in syringe X contains more atoms than the gas in syringe Y.

D The number of moles of HBr is more than the number of moles of CO_2.

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13 Which simple cell produces the most electrical energy?



14 When sulfur is heated it undergoes a .....1..... change as it melts.

Further heating causes the sulfur to undergo a .....2..... change and form sulfur dioxide.

Which words complete gaps 1 and 2?

	1	2
A	chemical	chemical
B	chemical	physical
C	physical	chemical
D	physical	physical

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15 Four statements about the effect of increasing temperature on a reaction are shown.

1 The activation energy becomes lower.

2 The particles move faster.

3 There are more collisions between reacting particles per second.

4 There are more collisions which have energy greater than the activation energy.

Which statements are correct?

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

16 An example of a redox reaction is shown.

$$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$$

Which statement about the reaction is correct?

A Zn is the oxidising agent and it oxidises Cu^{2+}.

B Zn is the oxidising agent and it reduces Cu^{2+}.

C Zn is the reducing agent and it oxidises Cu^{2+}.

D Zn is the reducing agent and it reduces Cu^{2+}.

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17 The equation for the decomposition of hydrogen iodide is shown.

$$2HI \rightarrow H_2 + I_2$$

Some bond energies are shown.

bond	bond energy in kJ / mol
H–H	440
I–I	150
H–I	300

What is the energy change for the reaction?

A –290 kJ / mol **B** –10 kJ / mol **C** +10 kJ / mol **D** +290 kJ / mol

18 Element X forms an oxide, XO, that neutralises sulfuric acid.

Which row describes X and XO?

	element X	nature of oxide, XO
A	metal	acidic
B	metal	basic
C	non-metal	acidic
D	non-metal	basic

19 Aqueous solutions of sodium sulfate and barium chloride are mixed.

$$Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$$

Which process is used to separate a sample of barium sulfate from the reaction mixture?

A precipitation

B filtration

C evaporation

D distillation

20 Information about element J is shown.

- Its atoms have four electrons in their outer shell.
- It is a non-metal.
- Its oxide has a macromolecular structure.
- It has a high melting point.

What is J?

A beryllium

B carbon

C silicon

D sulfur

21 Which property is shown by transition elements?

A low density

B low melting point

C variable oxidation state

D white compounds

22 Helium and neon exist as monoatomic gases at room temperature and pressure.

statement 1 Helium and neon have eight electrons in their outer shell.

statement 2 Helium and neon are unreactive.

Which option is correct?

A Statement 1 and statement 2 are incorrect.

B Statement 1 is correct and explains statement 2.

C Statement 1 is correct, but does not explain statement 2.

D Statement 1 is incorrect, but statement 2 is correct.

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23 What are possible effects of an inadequate water supply during a drought?

1 crop failure

2 wastage of water

3 human disease

4 death of farm animals

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

24 Which statement explains why galvanising prevents iron from rusting?

A Zinc is more reactive than iron and corrodes in preference to iron.

B Zinc is more reactive than iron and loses electrons less easily than iron.

C Zinc is less reactive than iron and corrodes in preference to iron.

D Zinc is less reactive than iron and loses electrons more easily than iron.

25 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

26 Which compounds are released by the extraction of zinc from zinc blende and by respiration?

	extraction of zinc	respiration
A	CO_2 and SO_2	CO_2 only
B	CO_2 and SO_2	CO_2 and H_2O
C	CO_2 only	CO_2 only
D	CO_2 only	CO_2 and H_2O

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27 Which gas is an air pollutant that causes acid rain?

A argon

B carbon monoxide

C methane

D nitrogen dioxide

28 Ammonia is made from nitrogen and hydrogen. The equation for the reaction is shown.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

The forward reaction is exothermic.

Which conditions give the greatest equilibrium yield of ammonia?

	temperature / °C	pressure / atm
A	200	15
B	200	150
C	500	15
D	500	150

29 Which reaction does **not** occur during the extraction of iron from hematite in a blast furnace?

A $C + O_2 \rightarrow CO_2$

B $CaO + SiO_2 \rightarrow CaSiO_3$

C $CO_2 + C \rightarrow 2CO$

D $4Fe + 3O_2 \rightarrow 2Fe_2O_3$

30 Which substance is used as a catalyst in the manufacture of sulfuric acid by the Contact process?

A iron

B nickel

C phosphoric acid

D vanadium(V) oxide

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31 Metal X is a good conductor of electricity and is used for electrical wiring.

Metal Y is used to make an alloy which is resistant to corrosion and is used to make cutlery.

Metal Z is light and strong and is used in the manufacture of aircraft.

What are X, Y and Z?

	X	Y	Z
A	aluminium	iron	copper
B	copper	iron	aluminium
C	aluminium	copper	iron
D	copper	aluminium	iron

32 The formulae of two compounds of manganese are MnO_2 and $KMnO_4$.

In these two compounds the oxidation state of potassium is +1 and the oxidation state of oxygen is –2.

What are the oxidation states of manganese in each of these two compounds?

	MnO_2	$KMnO_4$
A	+2	+3
B	+2	+7
C	+4	+3
D	+4	+7

33 Which statement about calcium carbonate is correct?

A It is made by the thermal decomposition of limestone.

B It is used to neutralise alkaline soils.

C It is a reactant in the test for carbon dioxide.

D It is used to remove impurities in iron extraction.

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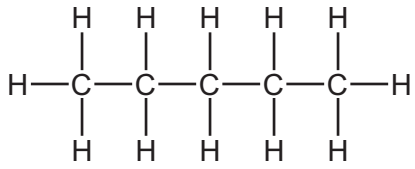
34 Ethanol is reacted with acidified potassium manganate(VII).

Which row describes the type of reaction and the type of organic compound formed?

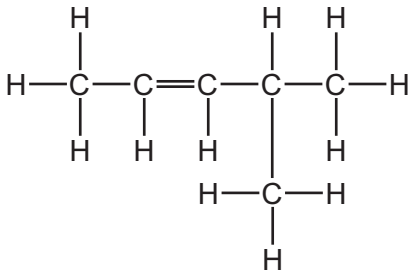
	type of reaction	organic compound
A	oxidation	carboxylic acid
B	oxidation	alkene
C	dehydration	carboxylic acid
D	dehydration	alkene

35 The diagrams show the structural formulae of four compounds.

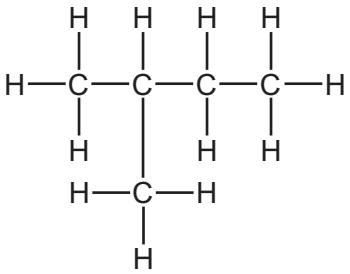
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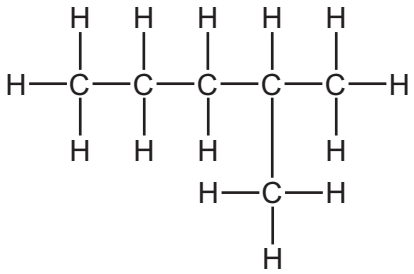
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3



4



Which two compounds are structural isomers?

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

36 Which statement about alkanes is correct?

A They burn in oxygen.

B They contain carbon, hydrogen and oxygen atoms.

C They contain double bonds.

D They contain ionic bonds.

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37 How much hydrogen is needed to react completely with 0.02 moles of butene to make butane?

A 0.24 dm^3 **B** 0.48 dm^3 **C** 0.96 dm^3 **D** 1.20 dm^3

38 What is an advantage of the fermentation process for producing ethanol compared with the catalytic addition of steam to ethene?

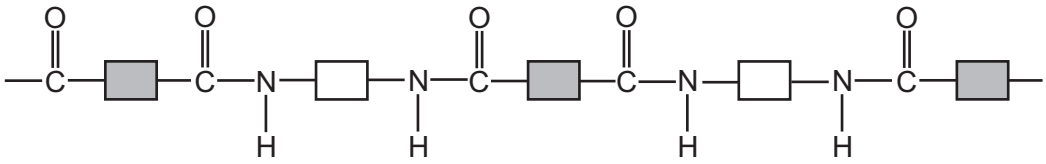
A Fermentation requires less heat energy.

B Ethanol from fermentation needs to be distilled.

C Raw materials for fermentation are non-renewable.

D The fermentation process is carried out in batches rather than continuously.

39 The structure of a synthetic polymer is shown.



The structure shows that it is a .....1..... . It is formed by .....2..... polymerisation.

Which words complete gaps 1 and 2?

	1	2
A	polyamide	addition
B	polyamide	condensation
C	polyester	addition
D	polyester	condensation

40 Which substance is a natural polymer?

A ethene

B *Terylene*

C nylon

D protein

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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.).