Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/23**

Paper 2 Multiple Choice (Extended) **October/November 2020**

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. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

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1 Which gas has the slowest rate of diffusion?

A H_2 **B** NH_3 **C** CH_4 **D** CO_2

2 When a dark grey solid element is heated, it changes directly into a purple gas.

Which word describes this change?

A boiling

B evaporation

C melting

D sublimation

3 Nickel(II) sulfate is a green solid that is soluble in water.

Which method is used to obtain a pure sample of nickel(II) sulfate crystals from a mixture of nickel(II) sulfate and sand?

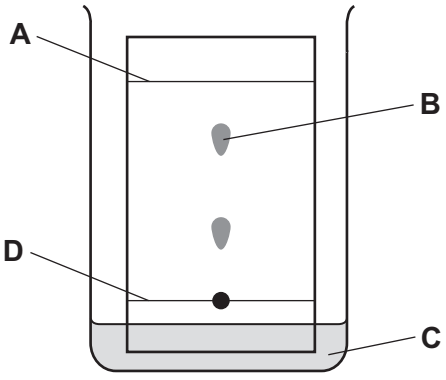
A Heat the mixture with water and distil it to give nickel(II) sulfate.

B Heat the mixture with water and leave it to crystallise.

C Heat the mixture with water and filter off the nickel(II) sulfate.

D Heat the mixture with water, filter and allow the solution to crystallise.

4 In the chromatography experiment shown, which label represents the solvent front?



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5 Molecules containing only non-metal atoms are covalently bonded.

The formulae of four covalently bonded molecules are given below:

1 nitrogen, N_2

2 carbon dioxide, CO_2

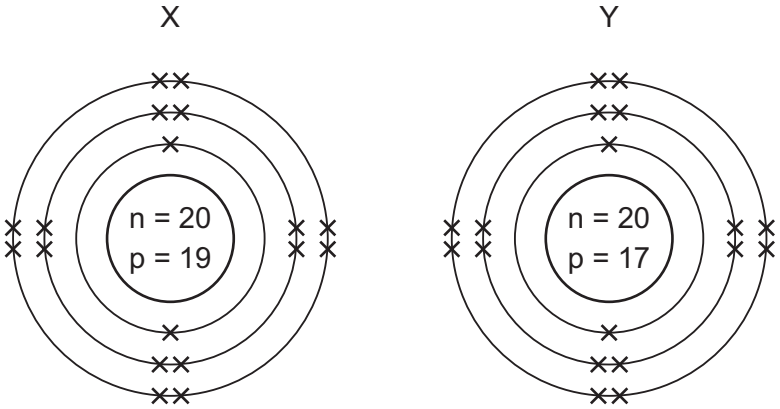
3 ethene, C_2H_4

4 methanol, CH_3OH

Which of the molecules contain double bonds?

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

6 The arrangements of the electrons in two ions formed from elements X and Y are shown.



Which equation represents the reaction between elements X and Y?

A $X_2 + 2Y \rightarrow 2X^+ + 2Y^-$

B $X_2 + 2Y \rightarrow 2X^- + 2Y^+$

C $2X + Y_2 \rightarrow 2X^+ + 2Y^-$

D $2X + Y_2 \rightarrow 2X^- + 2Y^+$

7 Magnesium reacts with sulfuric acid.

What are the formulae of the products formed in this reaction?

A $MgSO_4$ and H_2

B $MgSO_4$ and H_2O

C $Mg(SO_4)_2$ and H_2

D $Mg(SO_4)_2$ and H_2O

8 Sodium reacts with chlorine to form sodium chloride.

Which row describes the bonding in the three substances?

	sodium	chlorine	sodium chloride
A	covalent	covalent	covalent
B	covalent	metallic	ionic
C	metallic	covalent	ionic
D	metallic	metallic	covalent

9 Rubidium is in Group I of the Periodic Table and bromine is in Group VII.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion?

	electron change	formula of ion formed
A	electron gained	Rb^+
B	electron gained	Rb^-
C	electron lost	Rb^+
D	electron lost	Rb^-

10 Which statement explains why graphite is used as a lubricant?

A All bonds between the atoms are weak.

B It conducts electricity.

C It has a low melting point.

D Layers in the structure can slide over each other.

11 The relative atomic mass of chlorine is 35.5.

When calculating relative atomic mass, which particle is the mass of a chlorine atom compared to?

A a neutron

B a proton

C an atom of carbon-12

D an atom of hydrogen-1

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12 What is the empirical formula of an oxide of iron, formed by reacting 2.24 g of iron with 0.96 g of oxygen?

A FeO **B** Fe_2O **C** Fe_2O_3 **D** Fe_3O_4

13 Electrolysis is carried out on dilute aqueous potassium bromide.

Which products are formed at the anode and the cathode?

	anode	cathode
A	bromine	hydrogen
B	bromine	potassium
C	hydrogen	bromine
D	hydrogen	potassium

14 Which substance does **not** require oxygen in order to produce energy?

A coal

B hydrogen

C natural gas

D ^{235}U

15 Ethanol is used as a fuel.

$$\text{ethanol} + \text{oxygen} \rightarrow \text{carbon dioxide} + \text{water}$$

Which statements are correct?

1 The reaction is endothermic.

2 The products have more energy than the reactants.

3 The oxygen for this reaction comes from the air.

4 The temperature of the reaction mixture rises during this reaction.

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

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16 The reaction between hydrogen and oxygen releases 486 kJ / mol of energy.

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

The bond energy of H–H is 436 kJ / mol and that of H–O is 464 kJ / mol.

What is the bond energy of O=O?

A 430 kJ / mol

B 458 kJ / mol

C 498 kJ / mol

D 984 kJ / mol

17 Which reaction of hydrochloric acid is a redox reaction?

A $2Na + 2HCl \rightarrow 2NaCl + H_2$

B $Na_2O + 2HCl \rightarrow 2NaCl + H_2O$

C $NaOH + HCl \rightarrow NaCl + H_2O$

D $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

18 Which reaction is an example of a photochemical reaction?

A glucose forming carbon dioxide and water

B magnesium reacting with oxygen

C potassium reacting with water

D silver chloride forming silver metal

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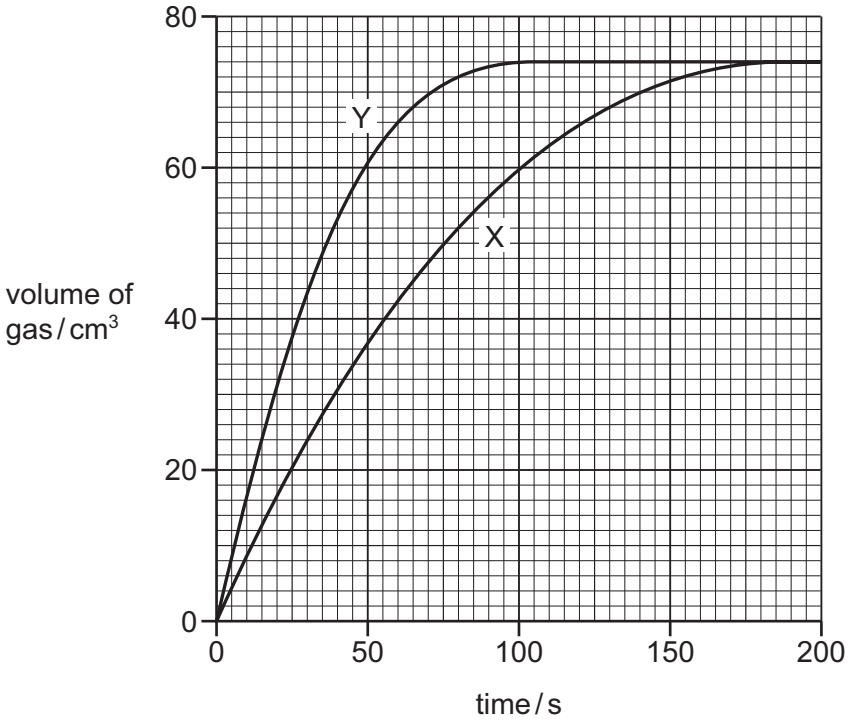
19 An excess of calcium carbonate is added to dilute hydrochloric acid, X.

The carbon dioxide gas given off is collected and its volume recorded at regular time intervals.

Line X on the graph shows the results obtained.

The experiment is repeated using dilute hydrochloric acid, Y.

Line Y on the graph shows the results obtained.



Which statement about the two hydrochloric acid samples, X and Y, is correct?

A They had the same volume but Y had higher concentration.

B They had the same concentration but Y had a larger volume.

C X had a higher concentration but Y had a larger volume.

D Y had a higher concentration but X had a larger volume.

20 Period 3 of the Periodic Table contains the elements sodium to argon.

Element Q is a non-metal from this period.

Which statement about Q is correct?

A It conducts electricity.

B It has a lower proton number than sodium.

C It has electrons in only three shells.

D It is malleable.

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[Turn over

21 Which metal has variable oxidation states?

A aluminium

B calcium

C copper

D sodium

22 An aqueous cation reacts with aqueous sodium hydroxide to form a white precipitate.

The precipitate is insoluble in excess sodium hydroxide.

What is the aqueous cation?

A aluminium ion

B calcium ion

C chromium ion

D zinc ion

23 Zinc oxide is an amphoteric oxide.

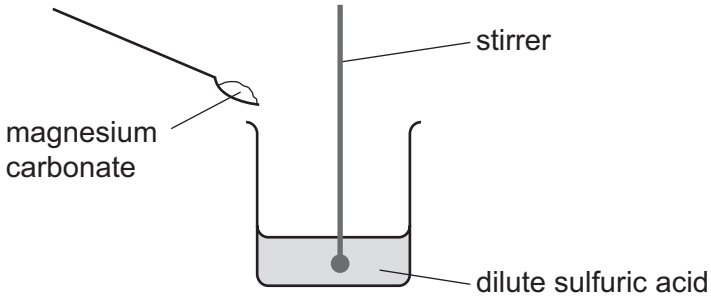
Which row describes the reactions of zinc oxide?

	reaction with alkalis	reaction with acids
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

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24 A student carries out an experiment to prepare pure magnesium sulfate crystals.

The diagram shows the first stage of the preparation.



He adds magnesium carbonate until no more reacts.

Which process should he use for the next stage?

A crystallisation

B evaporation

C filtration

D neutralisation

25 Which statement about the halogens and their compounds is correct?

A The colour of the element gets lighter going down Group VII.

B The elements get less dense going down Group VII.

C When chlorine is added to sodium iodide solution, iodine is formed.

D When iodine is added to sodium bromide solution, bromine is formed.

26 Elements in Group II of the Periodic Table show the same trends in their reaction with water and their density as Group I.

Which row shows how the properties of barium compare with calcium?

	reaction with water	density
A	faster	higher
B	faster	lower
C	slower	higher
D	slower	lower

27 A flammable gas needs to be removed from a tank at an industrial plant.

For safety reasons, an inert gas is used.

Which gas is suitable?

A argon

B hydrogen

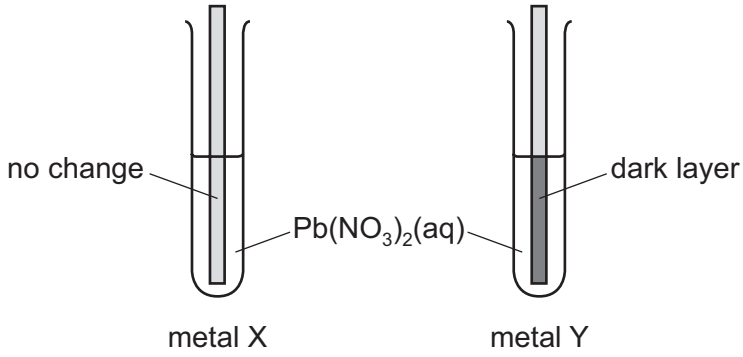
C methane

D oxygen

28 An experiment is performed to determine the order of reactivity of metals X and Y compared to lead.

Strips of each metal were added to separate test-tubes containing aqueous lead(II) nitrate, $Pb(NO_3)_2$.

The results are shown.



What is the order of reactivity, least reactive first?

A Pb → X → Y

B X → Y → Pb

C X → Pb → Y

D Y → Pb → X

29 The equation for the reaction between iron(III) oxide and carbon monoxide is shown.

$$Fe_2O_3 + xCO \rightarrow yFe + zCO_2$$

Which values of x, y and z balance the equation?

	x	y	z
A	2	2	2
B	2	3	3
C	3	1	3
D	3	2	3

30 Which process is used to separate oxygen from liquid air?

A chromatography

B distillation

C filtration

D fractional distillation

31 What is the catalyst in the Haber process?

A Fe **B** Ni **C** Pt **D** V_2O_5

32 Ammonia is manufactured in an exothermic reaction.

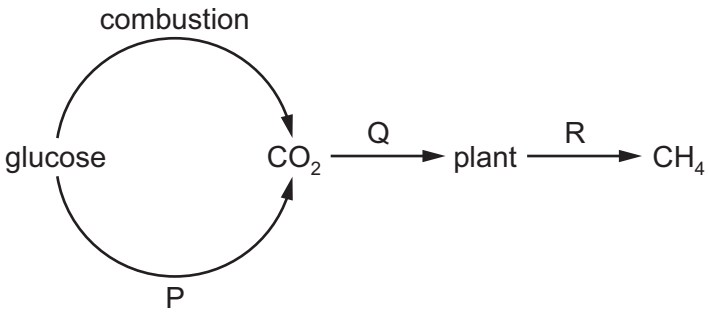
$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

What is the effect of lowering the pressure on the rate of formation of ammonia and percentage yield of ammonia at equilibrium?

	rate of formation	percentage yield
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

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33 Part of the carbon cycle is shown.



What are processes P, Q and R?

	P	Q	R
A	decomposition	respiration	photosynthesis
B	respiration	photosynthesis	decomposition
C	respiration	decomposition	photosynthesis
D	photosynthesis	respiration	decomposition

34 Which row shows the conditions used for the manufacture of sulfuric acid in the Contact process?

	pressure / atm	temperature / °C	catalyst
A	250	200	vanadium(V) oxide
B	2	450	vanadium(V) oxide
C	250	200	iron
D	2	450	iron

35 Which calcium compound does **not** neutralise an acid soil?

A calcium oxide

B calcium sulfate

C calcium hydroxide

D calcium carbonate

36 Which product is obtained when bromine reacts with propene, $CH_3CH{=}CH_2$?

A $CH_3CH{=}CHBr$

B $CH_3CBr{=}CHBr$

C $CH_3CH_2CHBr_2$

D $CH_3CHBrCH_2Br$

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37 Propanol is oxidised by acidified potassium manganate(VII) in a similar way to ethanol.

Which compound is produced by the oxidation of propanol with acidified potassium manganate(VII)?

A CH_3CH_2OH

B $CH_3CH_2CH_2OH$

C CH_3COOH

D CH_3CH_2COOH

38 The flow chart shows the preparation of ethanol and some important chemistry of ethanol.

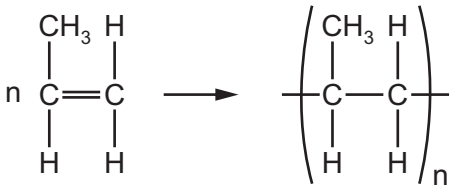
substance X $\xrightarrow{\text{fermentation}}$ ethanol $\xrightarrow{\text{process Y}}$ carbon dioxide + substance Z

What are X, Y and Z?

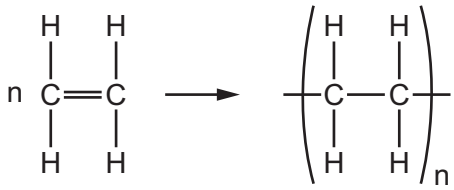
	X	Y	Z
A	yeast	combustion	oxygen
B	glucose	combustion	steam
C	glucose	polymerisation	water
D	yeast	fermentation	glucose

39 Which equation represents the formation of poly(propene) from propene?

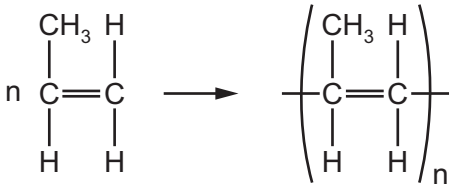
A



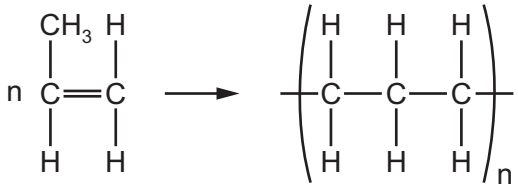
B



C

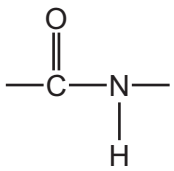


D

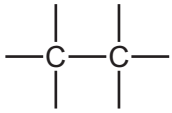


40 Which type of linkage joins the amino acids in a protein?

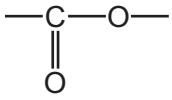
A



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.).