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.

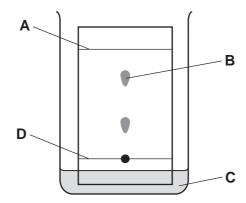
- 1 Which gas has the slowest rate of diffusion?
 - \mathbf{A} H_2
- B NH₃
- C CH₄
- D CO_2
- 2 When a dark grey solid element is heated, it changes directly into a purple gas.

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?



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

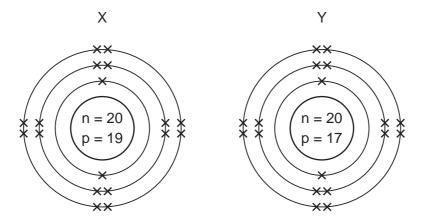
The formulae of four covalently bonded molecules are given below:

- 1 nitrogen, N₂
- 2 carbon dioxide, CO₂
- 3 ethene, C₂H₄
- 4 methanol, CH₃OH

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?

- $A \quad X_2 + 2Y \rightarrow 2X^+ + 2Y^-$
- **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 MgSO₄ and H₂
- **B** MgSO₄ and H₂O
- \mathbf{C} Mg(SO₄)₂ and H₂
- **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
Α	covalent	covalent	covalent
В	covalent	metallic	ionic
С	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
Α	electron gained	Rb⁺
В	electron gained	Rb⁻
С	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

12	7) Vhat 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 Fe₂O

C Fe₂O₃

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
Α	bromine	hydrogen
В	bromine	potassium
С	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 235U

15 Ethanol is used as a fuel.

ethanol + oxygen
$$\rightarrow$$
 carbon dioxide + 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

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 + 2HC $l \rightarrow$ 2NaC $l + H_2$
 - **B** Na₂O + 2HC $l \rightarrow$ 2NaCl + H₂O
 - **C** NaOH + HC $l \rightarrow$ NaCl + H₂O
 - **D** Na₂CO₃ + 2HC $l \rightarrow$ 2NaCl + H₂O + CO₂
- 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

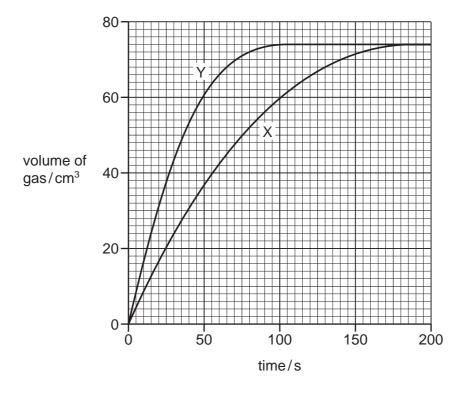
19 An excess of calcium carbonate is added to dilute hydrochloric acid, X.

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.

- 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?

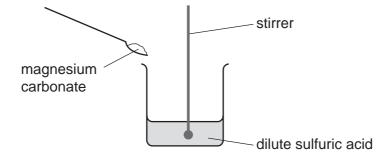
- **A** aluminium ion
- **B** calcium ion
- **C** chromium ion
- **D** zinc ion
- 23 Zinc oxide is an amphoteric oxide.

Which row describes the reactions of zinc oxide?

	reaction with alkalis	reaction with acids
Α	✓	✓
В	✓	X
С	X	✓
D	X	X

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
Α	faster	higher
В	faster	lower
С	slower	higher
D	slower	lower

PMT

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

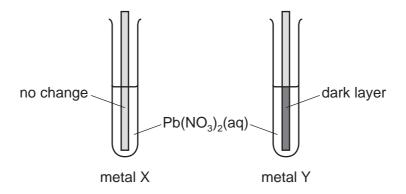
For safety reasons, an inert gas is used.

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?

- $\textbf{A} \quad Pb \to X \to Y$
- $\textbf{B} \quad X \to Y \to Pb$
- $\textbf{C} \quad X \to Pb \to Y$
- $\textbf{D} \quad Y \to Pb \to X$

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?

	Х	у	Z
Α	2	2	2
В	2	3	3
С	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.

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

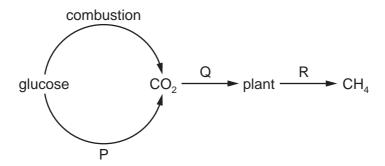
What is the effect of lowering the pressure on the rate of formation of ammonia and percentage yield of ammonia at equilibrium?

	rate of formation	percentage yield
Α	decreases	decreases
В	decreases	increases
С	increases	decreases
D	increases	increases

PMT

12

33 Part of the carbon cycle is shown.



What are processes P, Q and R?

	Р	Q	R					
Α	decomposition	respiration	photosynthesis					
В	respiration	photosynthesis	decomposition					
С	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
Α	250	200	vanadium (V) oxide
В	2	450	$vanadium(V) \ oxide \\$
С	250	200	iron
D	2	450	iron

- 35 Which calcium compound does not neutralise an acid soil?
 - calcium oxide
 - В calcium sulfate
 - calcium hydroxide
 - calcium carbonate D
- **36** Which product is obtained when bromine reacts with propene, CH₃CH=CH₂?
 - A CH₃CH=CHBr
 - B CH₃CBr=CHBr
 - C CH₃CH₂CHBr₂
 - D CH₃CHBrCH₂Br

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)?

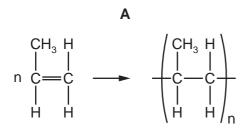
- A CH₃CH₂OH
- B CH₃CH₂CH₂OH
- C CH₃COOH
- D CH₃CH₂COOH
- **38** The flow chart shows the preparation of ethanol and some important chemistry of ethanol.

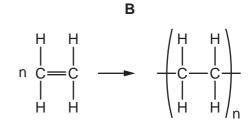
substance X
$$\xrightarrow{\text{fermentation}}$$
 ethanol $\xrightarrow{\text{process Y}}$ carbon dioxide + substance Z

What are X, Y and Z?

	Х	Y	Z				
Α	yeast	combustion	oxygen				
В	glucose	combustion	steam				
С	glucose	polymerisation	water				
D	yeast	fermentation	glucose				

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



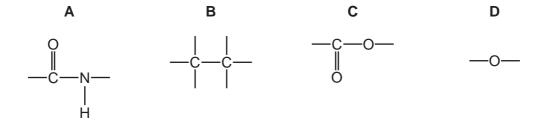


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PMT

14

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



15

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The Periodic Table of Elements

	IIIA IIA A	2	He	helium 4	60	О	oxygen fluorine	16 17	S C1	suffur chlorine argon 31 32 35.5 40	34 35	Se	selenium bromine 79 80	52 53	_ _	tellurium iodine 128 127	84 85	Po At	polonium astatine	116	^	livermorium
	≥	-								silicon ph 28										114	Εl	flerovium
	≡				5	М	boron 11	13	Αl	aluminium 27	31	Ga	gallium 70	49	드	indium 115	81	1L	thallium 204			
								•			30	Zu	zinc 65	48	S	cadmium 112	80	Ηg	mercury 201	112	S	copernicium
											29	D C	copper 64	47	Ag	silver 108	62	Αn	blog 197	111	Rg	roentgenium
Group											28	Z	nickel 59	46	Pd	palladium 106	78	₫	platinum 195	110	Ds	darmstadtium
G					,						27	ပိ	cobalt 59	45	R	rhodium 103	77	_	iridium 192	109	₩	meitnerium
		-	I	hydrogen 1							26	Ьe	iron 56	44	Ru	ruthenium 101	9/	SO	osmium 190	108	H	hassium
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						pol	ass				24	ပ်	chromium 52	42	Mo	molybdenum 96	74	≯	tungsten 184	106	Sg	seaborgium
				Key	atomic number	atomic symbo	name relative atomic mass				23	>	vanadium 51	41	g	niobium 93	73	Б	tantalum 181	105	op O	dubnium
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	_				3	:=	lithium 7	7	Na	sodium 23	19	¥	potassium 39	37	Rb	rubidium 85	55	S	caesium 133	87	Ē	francium

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Ce cerium pre 140 90 Th thorium p	09	ρN	neodymium 144	92	\supset	uranium	238
	59	P	praseodymium 141	91	Ра	protactinium	231
La lanthanum 139 89 Ac actinium	58	Ce	cerium 140	06	H	thorium	232
	22	Гa	lanthanum 139	88	Ac	actinium	ı

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).