Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **February/March 2024**

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.

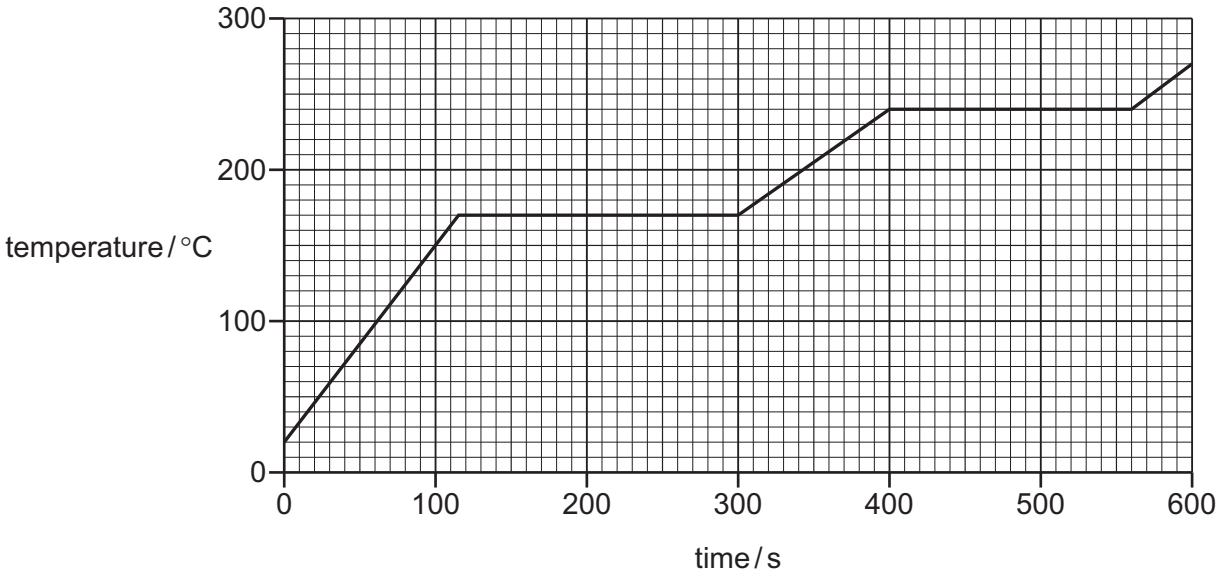
INFORMATION

- 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 Solid X is heated for 600 seconds.

The graph shows the heating curve that is obtained.



What is the melting point of X?

A 20 °C **B** 170 °C **C** 240 °C **D** 270 °C

2 Which statements about diffusion are correct?

1 Aqueous ions cannot diffuse in water.

2 Diffusion is caused by the random movement of particles.

3 Particles spread out in all directions in diffusion.

4 Diffusion can only take place in solids and liquids.

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

3 Which statement about an atom of fluorine, $^{19}_{9}F$, is correct?

A It contains a total of 28 protons, neutrons and electrons.

B It contains more protons than neutrons.

C Its isotopes contain different numbers of protons.

D Its nucleus contains 9 neutrons.

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4 Two of the isotopes of calcium are represented as $^{40}_{20}Ca$ and $^{44}_{20}Ca$.

Which statement explains why these isotopes of calcium have identical chemical properties?

A Both isotopes have the same number of neutrons.

B Both isotopes have an electronic configuration of 2,8,8,2.

C Both isotopes have a mass number of 20.

D Both isotopes have four fully occupied electron shells.

5 Which statement describes a property of potassium iodide?

A It is insoluble in water.

B It is a volatile substance.

C It has a low melting point.

D It conducts electricity when molten.

6 Methanal, CH_2O, has a boiling point of –19 °C.

At –20 °C, the liquid methanal is a non-conductor of electricity.

In a sample of methanal, each atom of carbon, hydrogen and oxygen has noble gas electronic configuration. Each atom has achieved this electronic configuration in one of three ways:

- gaining electrons
- losing electrons
- sharing electrons.

Which statement describes the bonding between the carbon atom and the oxygen atom in methanal?

A The carbon atom and the oxygen atom share four electrons.

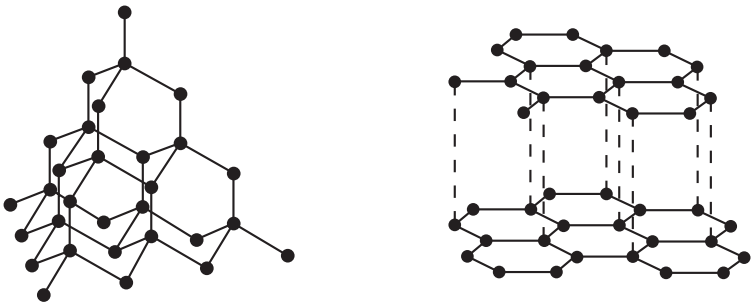
B The carbon atom and the oxygen atom share two electrons.

C Carbon is a negative ion and oxygen is a positive ion. These two ions attract each other.

D Carbon is a positive ion and oxygen is a negative ion. These two ions attract each other.

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7 The structures of diamond and graphite are shown.



Which statement about diamond and graphite is correct?

A Diamond and graphite contain strong covalent bonds between carbon atoms.

B Diamond and graphite have delocalised electrons.

C Diamond and graphite have layered structures.

D Diamond and graphite have low melting points.

8 Which row contains a description of metallic bonding and a property that is explained by reference to metallic bonding?

	description of metallic bonding	property explained by reference to metallic bonding
A	a lattice of negative ions in a sea of delocalised electrons	a metal will react with an acid, producing hydrogen
B	a lattice of negative ions in a sea of delocalised electrons	a piece of a metal can be moulded into different shapes
C	a lattice of positive ions in a sea of delocalised electrons	a metal will react with an acid, producing hydrogen
D	a lattice of positive ions in a sea of delocalised electrons	a piece of a metal can be moulded into different shapes

9 What is the relative molecular mass, M_r, of sulfur dioxide?

A 24 **B** 32 **C** 48 **D** 64

10 Magnetite is an ore of iron which contains the ions Fe^{2+}, Fe^{3+} and O^{2-} only.

What is the formula of magnetite?

A Fe_2O **B** Fe_2O_3 **C** Fe_3O_2 **D** Fe_3O_4

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11 Concentrated aqueous sodium chloride and dilute sulfuric acid are both electrolysed using inert electrodes.

Which row identifies the product at the cathode in each electrolysis?

	aqueous sodium chloride	dilute sulfuric acid
A	hydrogen	oxygen
B	hydrogen	hydrogen
C	chlorine	oxygen
D	chlorine	hydrogen

12 Electrolytes can be broken down by electrolysis.

Which rows are correct for each electrolyte?

	electrolyte	reaction at cathode	product at anode
1	dilute aqueous potassium chloride	$2H^+ + 2e^- \rightarrow H_2$	oxygen
2	concentrated hydrochloric acid	$2H^+ + 2e^- \rightarrow H_2$	chlorine
3	molten aluminium oxide	$2O^{2-} \rightarrow O_2 + 4e^-$	aluminium
4	concentrated aqueous sodium bromide	$Na^+ + e^- \rightarrow Na$	bromine

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

13 Which statement about hydrogen–oxygen fuel cells is correct?

A Hydrogen is extracted from clean, dry air.

B The only product is carbon dioxide.

C The reaction is endothermic.

D No toxic gases are produced.

14 Which statement defines the activation energy, E_a, for a reaction?

A It is the minimum energy that colliding particles must have to react.

B It is the minimum energy that endothermic reactions take in from their surroundings.

C It is the maximum energy that exothermic reactions transfer to their surroundings.

D It is the maximum energy released when the bonds in the products of a reaction form.

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15 The equation for the complete combustion of ethyne, H–C≡C–H, is shown.

$$2H–C{\equiv}C–H \; + \; 5O{=}O \; \rightarrow \; 4O{=}C{=}O \; + \; 2H–O–H$$

The bond energies are listed.

bond	bond energy in kJ / mol
C≡C	837
C–H	415
O=O	498
C=O	805
O–H	464

What is the enthalpy change of the reaction when **1 mol** of ethyne is completely burned?

A –2472 kJ / mol

B –1236 kJ / mol

C +1236 kJ / mol

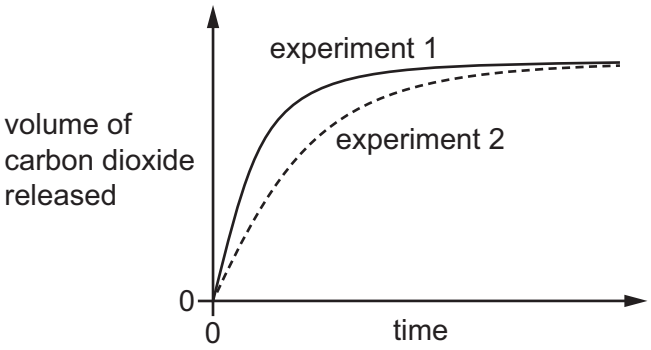
D +2472 kJ / mol

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16 In experiment 1, small lumps of limestone are added to dilute ethanoic acid at 40 °C.

The volume of carbon dioxide released is measured at regular time intervals.

A graph of the results is shown.



Which changes give the results shown in experiment 2?

	limestone	temperature / °C
A	large lumps	40
B	powder	40
C	powder	60
D	small lumps	60

17 In the Haber process, nitrogen and hydrogen are reacted to make ammonia.

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

The forward reaction is exothermic.

Which conditions produce the maximum yield of ammonia?

	pressure	temperature
A	high	high
B	high	low
C	low	high
D	low	low

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18 The Ostwald process is used to make nitric acid.

The conditions used in this process are:

1 a catalyst containing a transition element

2 a pressure of 10 atm

3 a temperature of 800 °C.

Which of these conditions are also used in the Contact process?

A 1 and 2

B 1 only

C 2 and 3

D 3 only

19 Hydrogen iodide is dissolved in water.

$$HI \rightarrow H^+ + I^-$$

Which row describes the final colours seen when the solution is tested with damp red litmus paper and with acidified aqueous potassium manganate(VII)?

	damp red litmus paper	acidified aqueous potassium manganate(VII)
A	blue	brown
B	blue	colourless
C	red	brown
D	red	colourless

20 Which statements about aqueous ethanoic acid are correct?

1 It can be produced by oxidising ethanol with potassium iodide.

2 It reacts with magnesium to produce hydrogen gas.

3 It has an approximate pH value of 3.

4 It produces esters called methanoates.

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

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21 Which element forms an acidic oxide?

A calcium

B lithium

C magnesium

D sulfur

22 Which statement describes the properties of hydrochloric acid?

A Carbon dioxide is produced when limestone reacts with hydrochloric acid.

B Hydrogen is produced when sodium hydroxide reacts with hydrochloric acid.

C Methyl orange turns yellow in strong hydrochloric acid.

D Red litmus paper turns blue when dipped into hydrochloric acid.

23 Elements P and Q have the same number of electron shells.

An atom of Q has more electrons in its outer electron shell than an atom of P.

Which statements are correct?

1 P and Q are in the same group of the Periodic Table.

2 P and Q are in the same period of the Periodic Table.

3 P has a greater tendency to form positive ions than Q.

4 The oxide of Q is more basic than the oxide of P.

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

24 Which substance reacts with dilute sulfuric acid to form a salt that can be removed from the resulting mixture by filtration?

A aqueous barium chloride

B aqueous sodium hydroxide

C copper

D copper(II) carbonate

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25 Astatine is below iodine in Group VII in the Periodic Table.

Which row describes the properties of astatine?

	state at room temperature	reactivity
A	gas	displaces chlorine, bromine and iodine
B	gas	displaces iodine but does not displace chlorine or bromine
C	solid	displaces iodine but does not displace chlorine or bromine
D	solid	does not displace chlorine, bromine or iodine

26 Which property of copper explains why it is classified as a transition element?

A Copper can be bent into different shapes.

B Copper forms Cu^{2+} and Cu^{+} ions.

C Copper is a good conductor of electricity.

D Copper has a low density.

27 Brass is an alloy that is formed from copper and zinc.

Which statements are correct?

1 Brass, copper and zinc all conduct electricity.

2 Brass is a compound of copper and zinc.

3 Brass is harder than zinc.

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

28 The equation for the reaction of metal M with aqueous zinc sulfate is shown.

$$M(s) + ZnSO_4(aq) \rightarrow MSO_4(aq) + Zn(s)$$

Which statement explains why metal M reacts with aqueous zinc sulfate?

A Zinc is less reactive than M because M is able to accept electrons from zinc ions.

B Zinc is a more powerful reducing agent than M.

C Zinc is more reactive than M because it can lose electrons more easily than M.

D Zinc ions can remove electrons from M.

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29 In the blast furnace, the impurity silicon(IV) oxide is removed by the formation of slag.

Which equation represents the formation of the substance which reacts with silicon(IV) oxide to form slag?

A $C + O_2 \rightarrow CO_2$

B $C + CO_2 \rightarrow 2CO$

C $CaCO_3 \rightarrow CaO + CO_2$

D $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

30 Aluminium is extracted from bauxite by electrolysis.

Which statement is correct?

A Aluminium ions are oxidised to form aluminium.

B The cathode has to be replaced regularly because it reacts with the oxygen which is formed.

C Carbon dioxide is produced at the anode.

D Cryolite is added to remove impurities.

31 Iron rusts but aluminium does **not** easily corrode.

Which statement explains why aluminium does **not** easily corrode?

A It is an alloy.

B It is below iron in the reactivity series.

C It is a transition element.

D Its surface is protected by an oxide layer.

32 Which chemicals can be used as a fertiliser to provide the three elements needed for improved plant growth?

A $(NH_2)_2CO$ and KCl

B $(NH_4)_2HPO_4$ and K_2SO_4

C $(NH_4)_2HPO_4$ and $(NH_2)_2CO$

D $(NH_2)_2CO$ and K_2SO_4

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[Turn over

33 What is the colour change when water is added to anhydrous cobalt(II) chloride?

A blue to white

B blue to pink

C white to blue

D white to pink

34 How do carbon dioxide and methane cause global warming?

A They emit the thermal energy they have absorbed back to the Earth.

B They absorb the radiation directly from the Sun.

C They increase thermal energy loss to space.

D They reduce reflection of thermal energy from the Earth's surface.

35 Four statements about photosynthesis are listed.

1 Chlorophyll is required for photosynthesis.

2 The equation for photosynthesis is $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$.

3 Photosynthesis requires energy from light.

4 Photosynthesis releases carbon dioxide, which can lead to climate change.

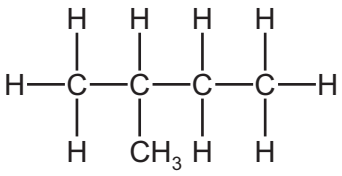
Which statements are correct?

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

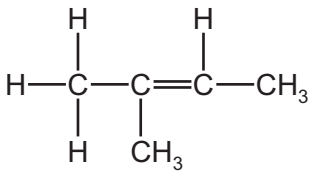
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36 Which molecules are structural isomers?

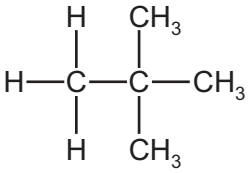
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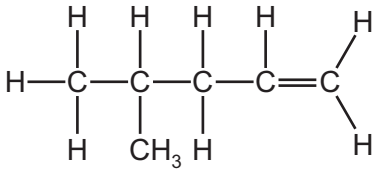
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3



4



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

37 Which statements about the reaction of ethene with steam are correct?

1 The product has a higher molecular mass than ethane.

2 The product reacts with aqueous bromine.

3 The number of electrons shared between carbon atoms decreases.

4 The reaction produces an alcohol and hydrogen.

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

38 Methane and chlorine react to form chloromethane.

Which row describes the necessary reaction condition and the type of reaction?

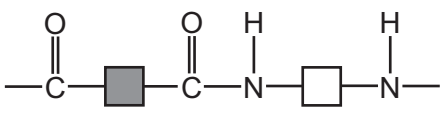
	reaction condition	type of reaction
A	ultraviolet light	substitution
B	nickel catalyst	substitution
C	nickel catalyst	addition
D	ultraviolet light	addition

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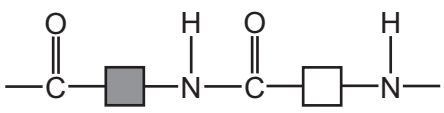
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39 Parts of the structure of two different polymers, X and Y, are shown.

X



Y

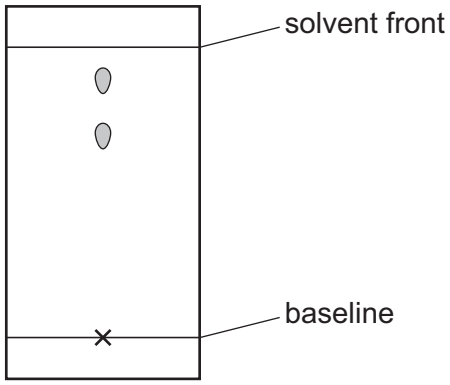


Which row about the monomers and the linkages between the monomers in polymers X and Y is correct?

	monomers in X and Y	linkages
A	different	the linkages in X are different from the linkages in Y
B	different	the linkages in X are the same as the linkages in Y
C	same	the linkages in X are different from the linkages in Y
D	same	the linkages in X are the same as the linkages in Y

40 Substance Q is tested using paper chromatography.

The resulting chromatogram is shown.



Which statement is correct?

A Q is a pure substance.

B The R_f value of the lower spot is 0.25.

C Q is a mixture of at least two different substances.

D Q is a compound of two elements.

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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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

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.).