Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/12**

Paper 1 Multiple Choice **October/November 2022**

1 hour

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.

IB22 11_5070_12/2RP

1 Which piece of apparatus would be the most suitable for measuring exactly 37.00 cm^3 of aqueous ammonia?

A a 50 cm^3 burette

B a 50 cm^3 pipette

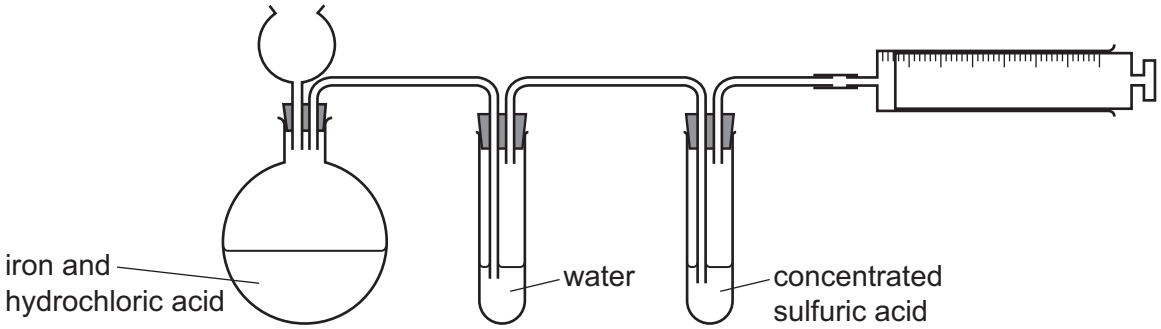
C a 50 cm^3 gas syringe

D a 50 cm^3 measuring cylinder

2 When iron reacts with dilute hydrochloric acid, hydrogen is formed. Impurities in the iron mean that some hydrogen sulfide gas is also formed. Hydrogen sulfide gas is soluble in water. Water vapour can be removed from a mixture of gases using concentrated sulfuric acid.

Which diagram shows apparatus suitable to prepare a pure, dry sample of hydrogen?

A



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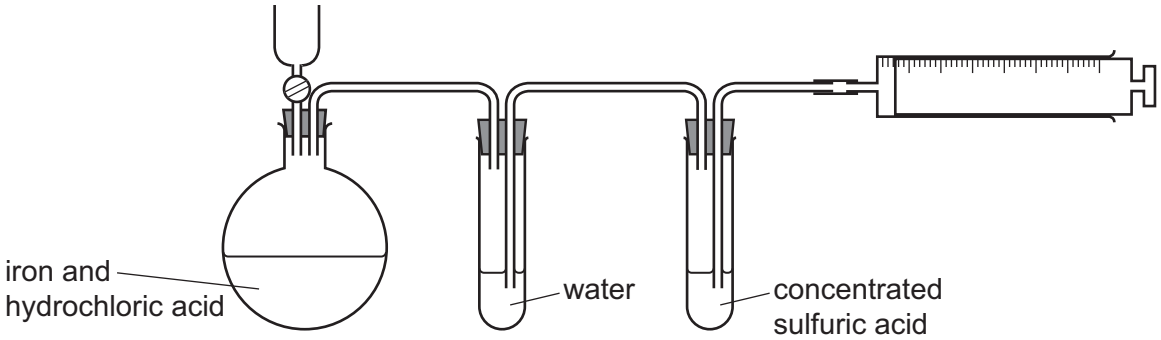

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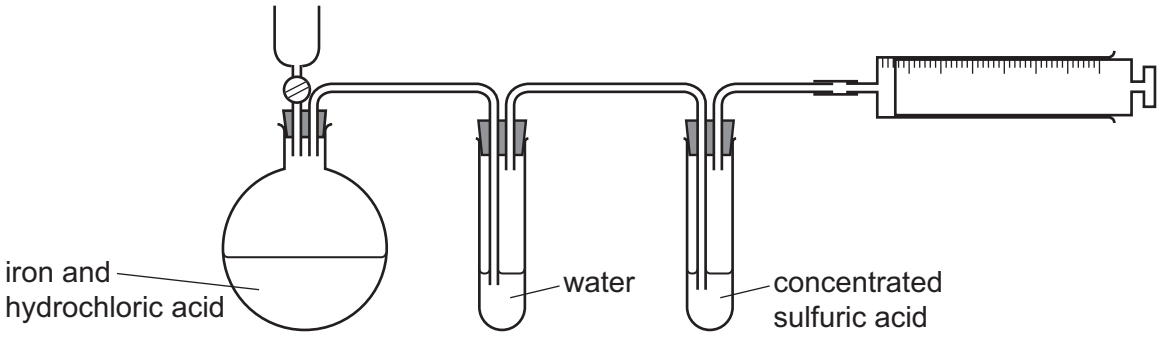

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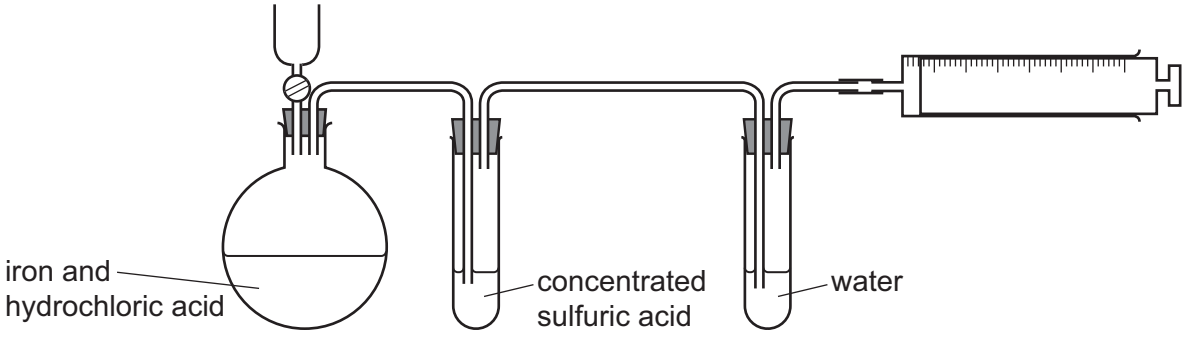


3 The following tests are carried out on a sample of green crystals.

The crystals are dissolved in water and the resulting solution is divided into two portions.

- Aqueous sodium hydroxide is added to the first portion. A green precipitate, soluble in excess aqueous sodium hydroxide, is formed.

  The solution formed is heated and a gas is produced which turns litmus paper blue.

- Dilute nitric acid is added to the second portion followed by aqueous barium nitrate. A white precipitate is formed.

Which three ions are present in the green crystals?

A ammonium, chromium(III), sulfate

B ammonium, iron(II), sulfate

C chromium(III), carbonate, sulfate

D iron(II), nitrate, sulfate

4 Changes of state occur between solids, liquids and gases.

$$\text{gas} \underset{\text{R}}{\overset{\text{P}}{\rightleftharpoons}} \text{liquid} \underset{\text{S}}{\overset{\text{Q}}{\rightleftharpoons}} \text{solid}$$

Which changes are occurring at P, Q, R and S?

	P	Q	R	S
A	boiling	melting	freezing	condensing
B	condensing	freezing	boiling	melting
C	freezing	condensing	boiling	melting
D	melting	boiling	condensing	freezing

5 The table shows information about some oxides.

	structure	effect of water
oxide	simple molecular	dissolves to form an acid

For which of the elements nitrogen, phosphorus, sulfur and silicon could this information about their oxides be correct?

A phosphorus and sulfur only

B nitrogen and silicon only

C nitrogen, phosphorus and sulfur only

D nitrogen, phosphorus, sulfur and silicon

6 Which statement about iodine atoms and iodide ions is correct?

A They are both isotopes of iodine.

B They undergo the same chemical reactions.

C They have the same number of protons.

D They have the same physical properties.

7 The table contains information about four substances.

Which substance is an ionic compound?

	state at room temperature	conducts electricity at room temperature	conducts electricity when molten	conducts electricity when in aqueous solution
A	liquid	✗	✗	✓
B	solid	✓	✓	✓
C	solid	✓	✓	insoluble
D	solid	✗	✓	✓

8 What is the nucleon number of the isotope of uranium, $^{235}_{92}U$?

A 92 **B** 143 **C** 235 **D** 327

9 An ionic compound has the formula Al_2O_3.

What are the charges on the ions?

A Al^{+} O^{-} **B** Al^{2+} O^{2-} **C** Al^{2+} O^{3-} **D** Al^{3+} O^{2-}

10 Which two pairs of atoms are held together by the same number of bonds?

	first pair of atoms	second pair of atoms
A	the two carbon atoms in a C_2H_4 molecule	the carbon atom and one oxygen atom in a CO_2 molecule
B	the two nitrogen atoms in an N_2 molecule	the two hydrogen atoms in an H_2 molecule
C	the two oxygen atoms in an O_2 molecule	the carbon atom and one hydrogen atom in a CH_4 molecule
D	the two oxygen atoms in an O_2 molecule	the two nitrogen atoms in an N_2 molecule

11 Boron trifluoride, BF_3, is a simple molecule. There are three covalent bonds in each BF_3 molecule. Each of these bonds is made by sharing one electron from the boron atom and one electron from a fluorine atom.

What is unusual about the bonding in boron trifluoride?

A It is unusual for a non-metal such as fluorine to form covalent bonds.

B The boron atom in each molecule does **not** gain the electronic configuration of a noble gas.

C The covalent bonds do **not** consist of shared pairs of electrons.

D The fluorine atoms in each molecule do **not** gain the electronic configuration of a noble gas.

12 Which equation is correct for the reaction between carbon dioxide and magnesium hydroxide?

A $CO_2 + Mg(OH)_2 \rightarrow MgCO_3 + H_2O$

B $CO_2 + 2Mg(OH)_2 \rightarrow 2MgCO_3 + 2H_2O$

C $2CO_2 + Mg(OH)_2 \rightarrow MgCO_3 + H_2O$

D $2CO_2 + Mg(OH)_2 \rightarrow 2MgCO_3 + H_2O$

13 Which mass of oxygen gas combines with exactly 16 g of sulfur to form sulfur dioxide, SO_2?

A 4 g **B** 8 g **C** 16 g **D** 32 g

14 Which compound has an empirical formula that is different from its molecular formula?

A butanol, $C_4H_{10}O$

B hydrogen peroxide, H_2O_2

C nitrogen dioxide, NO_2

D water, H_2O

15 4.0 g of sodium hydroxide, NaOH, is dissolved in 250 cm^3 of water in a graduated flask.

A 25 cm^3 sample of this solution is titrated with 0.50 mol / dm^3 hydrochloric acid.

Which volume of hydrochloric acid is required to exactly neutralise the alkali?

A 10 cm^3 **B** 20 cm^3 **C** 40 cm^3 **D** 200 cm^3

16 Dilute aqueous solutions of potassium chloride and magnesium chloride are mixed together.

A sample of the mixture is electrolysed using inert electrodes.

What are possible products at each of the electrodes?

	anode	cathode
A	chlorine	oxygen
B	chlorine	potassium
C	oxygen	hydrogen
D	oxygen	magnesium

17 The table gives some statements about electrolysis and the reason why each statement is true.

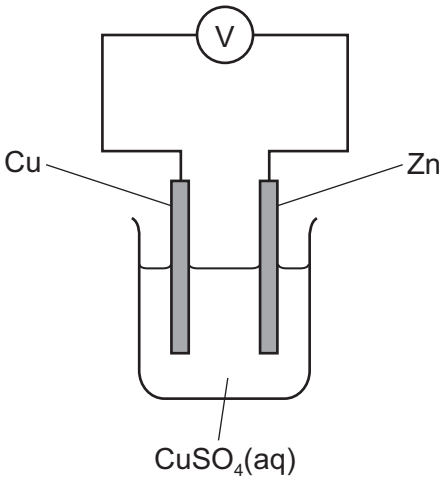
Which row shows a correct statement and the correct reason why the statement is true?

	statement	reason
A	Aqueous copper(II) sulfate and aqueous copper(II) nitrate are suitable electrolytes when used to copper plate objects.	Both solutions contain $Cu^{2+}(aq)$ and can transfer copper from the anode to the cathode.
B	During the extraction of aluminium from aluminium oxide the carbon anodes have to be replaced regularly.	The anodes gradually dissolve in the molten cryolite.
C	In the electrolysis of concentrated aqueous sodium chloride and of dilute sulfuric acid the same products are formed.	$H^{+}(aq)$ is present in both aqueous solutions.
D	When an aqueous mixture of zinc nitrate and copper(II) sulfate is electrolysed, zinc is formed on the cathode.	Zinc is more reactive than copper.

18 Students proposed four cells to produce electricity in a school laboratory.

Which cell would produce the largest voltage in a safe way?

A



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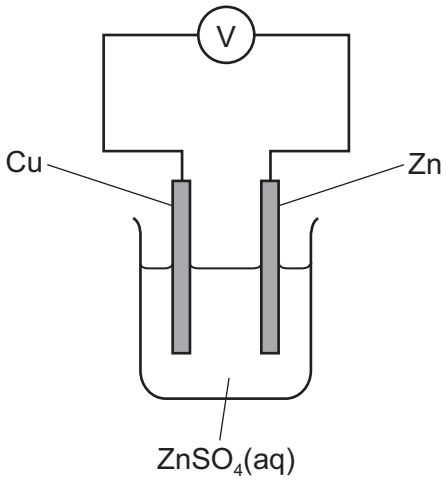

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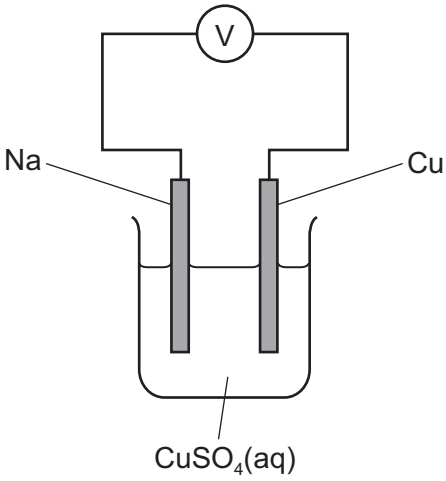

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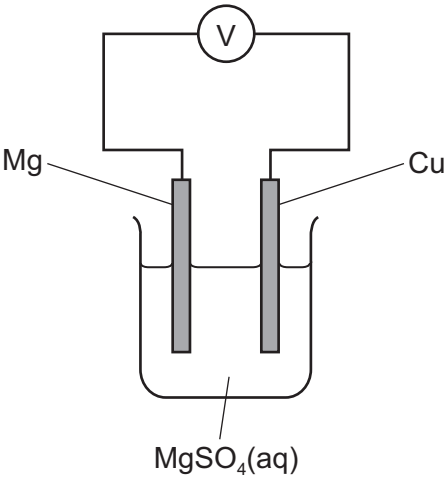


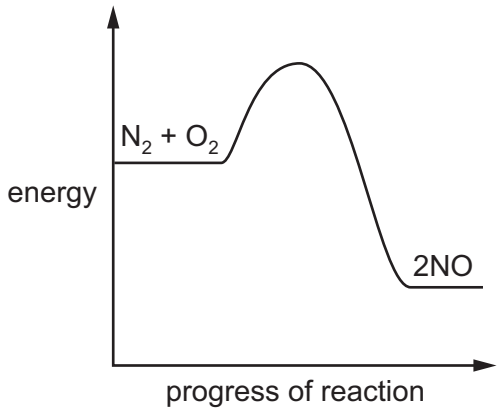
19 Nitrogen oxides may form in the atmosphere during lightning activity.

$$N_2 + O_2 \rightarrow 2NO$$

The reaction is endothermic.

Which energy profile diagram is correct for this reaction?

A



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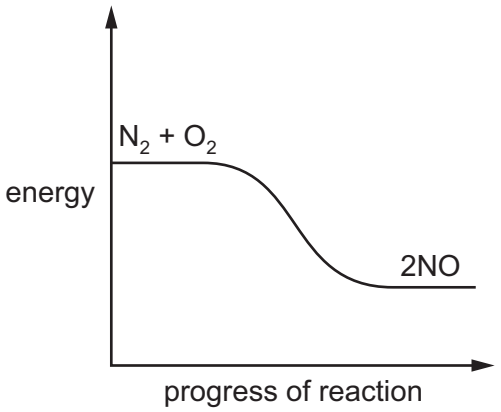

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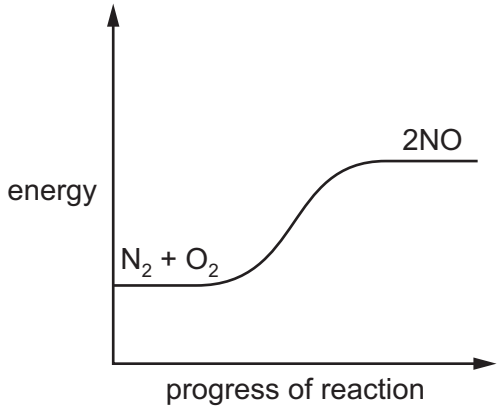

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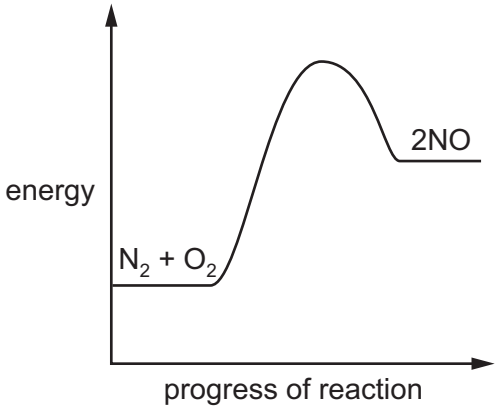


20 Which two processes are both endothermic?

A combustion and cracking

B combustion and fermentation

C cracking and photosynthesis

D respiration and photosynthesis

21 Magnesium reacts with dilute sulfuric acid.

$$Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g)$$

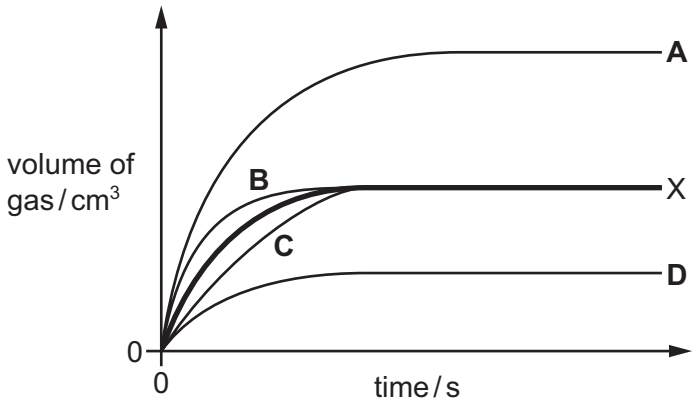
Which changes in the conditions will result in the lowest rate of production of hydrogen?

	acid concentration	solid particle size	temperature
A	decrease	decrease	increase
B	decrease	increase	decrease
C	increase	decrease	increase
D	increase	increase	decrease

22 Carbonates react with dilute acids to produce carbon dioxide. A student uses excess carbonate and 100 cm^3 of 0.1 mol/dm^3 acid and measures the volume of gas produced at regular time intervals.

The results give line X on the graph. The student repeats the experiment using 50 cm^3 of 0.2 mol/dm^3 acid whilst keeping everything else the same.

Which line shows the results for the second experiment?



23 In the Contact process, sulfur is converted into sulfuric acid. A catalyst is added to the reaction mixture shown in the equation.

$$2SO_2 + O_2 \rightleftharpoons 2SO_3$$

What is the purpose of the catalyst?

A to lower the activation energy for the reaction

B to oxidise the sulfur dioxide

C to reduce the sulfur dioxide

D to shift the equilibrium to the right

24 Which change involves reduction?

A calcium carbonate to calcium oxide

B copper to brass

C ethene to poly(ethene)

D sand to silicon

25 Under certain conditions, iron reacts with chlorine to form iron(III) chloride.

$$2Fe + 3Cl_2 \rightarrow 2FeCl_3$$

Which statement about this reaction is correct?

A Chlorine is the oxidising agent.

B Iron gains electrons.

C Iron is reduced.

D This is **not** a redox reaction.

26 The equation shows a reaction in the Contact process.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g) \qquad \Delta H = -196\,kJ/mol$$

Which change would move the position of equilibrium to the left?

A adding more O_2

B increasing the pressure

C increasing the temperature

D removing SO_3 from the reacting mixture

27 The table shows the pH values of some substances that can be consumed by humans.

substance	pH value
P	6.6
Q	3.1
R	10.4
S	7.8

Which statement about these substances is correct?

A P is alkaline.

B Q has the lowest concentration of hydrogen ions.

C R can neutralise excess stomach acid.

D S has a pH value closest to neutral.

28 Solution X is added to a solid salt, causing gas Y to be evolved.

Gas Y dissolves in water resulting in a solution with a pH of less than 7.

What are the possible identities of X and Y?

	X	Y
A	aqueous sodium hydroxide	ammonia
B	aqueous sodium hydroxide	carbon dioxide
C	dilute hydrochloric acid	ammonia
D	dilute hydrochloric acid	carbon dioxide

29 Which substance reacts with dilute sulfuric acid in the preparation of a pure sample of lead(II) sulfate?

A aqueous lead(II) nitrate

B lead foil

C powdered lead(II) carbonate

D powdered lead(II) oxide

30 A pure sample of a salt is obtained by filtration followed by evaporation of the filtrate.

Which pair of reagents would produce the salt?

A copper and hydrochloric acid

B excess copper(II) carbonate and hydrochloric acid

C aqueous silver nitrate and hydrochloric acid

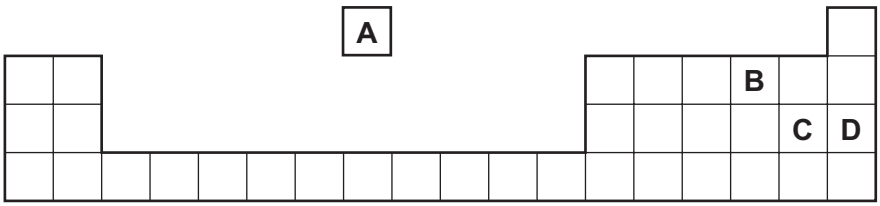
D aqueous sodium hydroxide and hydrochloric acid

31 Which set of conditions is used in the Contact process?

	temperature / °C	pressure / atm	catalyst
A	100–200	200	V_2O_5
B	100–200	1–2	Fe
C	400–500	1–2	V_2O_5
D	400–500	200	V_2O_5

32 Part of the Periodic Table is shown.

Which substance is an unreactive gas found in the atmosphere?



33 Iron is obtained in the blast furnace from the ore haematite.

Which statement is correct?

A Calcium carbonate is used to remove acidic impurities.

B Coke is reduced to carbon dioxide.

C Haematite is oxidised by carbon monoxide.

D Haematite undergoes thermal decomposition.

34 Pollution may be caused by oxides of carbon, nitrogen and sulfur.

Which elements can each form more than one oxide?

A carbon, nitrogen and sulfur

B carbon and nitrogen only

C carbon and sulfur only

D nitrogen and sulfur only

35 A river runs through an area of land that is used for growing cotton. The cotton farmers applied a large amount of fertiliser to their fields. This caused eutrophication in the river water.

Which statement is correct?

A Decreased levels of mineral salts caused the eutrophication.

B Desalination of the river water occurred.

C Increased levels of phosphates caused the eutrophication.

D Oxygen levels in the river water increased.

36 Which compound is an alkane?

A $CH_2CHCH_2CH_3$

B $CH_3CH(CH_3)CH_3$

C $CH_3CHCHCH_3$

D $(CH_3)_2CCH_2$

37 The equation shows the reaction that takes place when butanol is completely combusted in air.

$$C_4H_9OH(l) + xO_2(g) \rightarrow yCO_2(g) + zH_2O(g)$$

What are the values of *x*, *y* and *z*?

	x	*y*	*z*
A	4	6	5
B	5	4	6
C	5	6	4
D	6	4	5

38 Propanoic acid reacts with calcium carbonate. The products of this reaction are calcium propanoate, carbon dioxide and water.

What is the equation for this reaction?

A $2C_2H_5COOH + Ca_2CO_3 \rightarrow 2C_2H_5COOCa + CO_2 + H_2O$

B $2C_2H_5COOH + CaCO_3 \rightarrow (C_2H_5COO)_2Ca + CO_2 + H_2O$

C $2C_3H_7COOH + Ca_2CO_3 \rightarrow 2C_3H_7COOCa + CO_2 + H_2O$

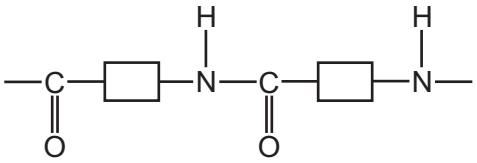
D $2C_3H_7COOH + CaCO_3 \rightarrow (C_3H_7COO)_2Ca + CO_2 + H_2O$

39 Which row shows all the elements present in the polymers listed?

- nylon
- poly(ethene)
- *Terylene*

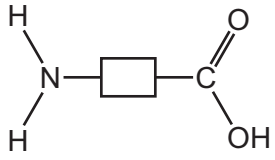
	nylon	poly(ethene)	*Terylene*
A	C, H	C, H, O	C, H, N, O
B	C, H, N, O	C, H	C, H, N, O
C	C, H, O	C, H, N	C, H, O
D	C, H, N, O	C, H	C, H, O

40 The partial structure of a polyamide is shown.



Which monomers would produce this polymer?

1



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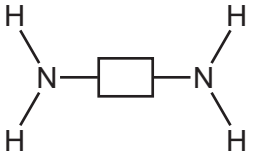

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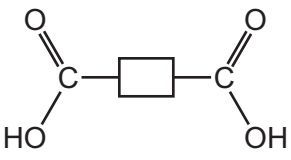

A 1 only **B** 1 and 2 **C** 1 and 3 **D** 2 and 3

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.).