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CONVENT OF THE HOLY INFANT JESUS SECONDARY
Preliminary Examination in preparation for
the General Certificate of Education Ordinary Level 2024

CANDIDATE NAME			
CLASS		REGISTER NUMBER	

CHEMISTRY 6092/01

Paper 1 Multiple Choice **26 August 2024**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the Multiple Choice Answer Sheet provided.

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 separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done on the question paper.
A copy of the Periodic Table is printed on page 16.
The use of an approved scientific calculator is expected, where appropriate.

1 A laboratory assistant has a mixture of solid sulfur and solid carbon.
Sulfur is very soluble in carbon disulfide (boiling point 46°C) and slightly soluble in water. Carbon is insoluble in both solvents.

A sample of the mixture is shaken with water. This is P.
Another sample of the mixture is shaken with carbon disulfide. This is Q.

Which procedure is used to prepare a pure sample of sulfur?

A P is distilled and the distillate is evaporated to dryness to obtain sulfur.

B P is filtered and the filtrate is allowed to evaporate to dryness to obtain sulfur.

C Q is filtered and the residue is allowed to evaporate to dryness to obtain sulfur.

D Q is filtered and the filtrate is allowed to evaporate to dryness to obtain sulfur.

2 A student was given 4.0 g of magnesium carbonate powder and 100 cm^3 of 0.1 mol/dm^3 hydrochloric acid. He wants to determine the rate of reaction by measuring the change in mass of the reaction mixture.

Which apparatus is **not** likely to be used in this experiment?

A conical flask

B electronic mass balance

C stopwatch

D test-tube

3 In which situations do the particles move closer together?

1 A gas is heated from 0 °C to 25 °C.

2 The pressure of a gas is increased.

3 Steam condenses to form water.

4 Water evaporates at room temperature.

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

4 Two bottles are placed close together inside a large container at a temperature of 90 °C. One bottle contains 1.0 g of sulfur dioxide, the other bottle contains 1.0 g of ethanol.

compound	melting point / °C	boiling point / °C
ethanol	–114	78
sulfur dioxide	–72	–10

A detector is placed in the container 2.0 m away from the two bottles. The two bottles are opened at the same time.

Which row is correct?

	compound that reaches detector first	explanation
A	ethanol	ethanol has a lower M_r than sulfur dioxide
B	ethanol	liquids diffuse faster than gases
C	sulfur dioxide	gases diffuse faster than liquids
D	sulfur dioxide	ethanol has a higher M_r than sulfur dioxide

5 The letters X, Y and Z represent different atoms.

$^{37}_{17}X$ $^{37}_{18}Y$ $^{38}_{18}Z$

Which statement is correct?

A X and Y are the same element.

B X and Y have same number of neutrons.

C Y and Z have the same number of electrons.

D Z has more neutrons than X.

6 Why does magnesium oxide have a higher melting point than sodium chloride?

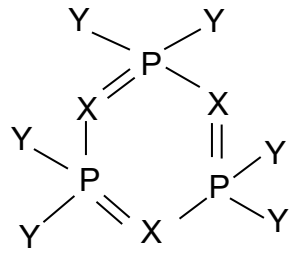
A There are more delocalised electrons in magnesium than sodium.

B There are more ions in magnesium oxide than in sodium chloride.

C The electrostatic forces of attraction between magnesium and oxide ions are stronger than those between sodium and chloride ions.

D The intermolecular forces of attraction between magnesium oxide are stronger than those between sodium chloride.

7 A stable molecule containing atoms of phosphorus, X, and Y have the following structure.



What elements could X and Y be?

	X	Y
A	C	H
B	N	C*l*
C	O	C*l*
D	Si	H

8 Which statement is true regarding diamond and graphite?

A Both can conduct electricity.
B Both have the same colour.
C Both have the same crystalline form.
D Both produce carbon dioxide and water vapour when completely burned in oxygen.

9 A compound contains 52% carbon, 13% hydrogen and 35% oxygen by mass.

What is the empirical formula of the compound?

A CH_3COOH **B** CH_3OH

C C_2H_5OH **D** $C_4H_{13}O_2$

10 Ethane burns in oxygen according to the chemical equation:

$$2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$$

4 dm^3 of ethane and 16 dm^3 of oxygen were ignited in a reaction vessel. After the reaction, the reaction vessel was cooled down to room temperature.

What is the final volume of gases present in the vessel?

A 8 dm^3

B 10 dm^3

C 20 dm^3

D 22 dm^3

11 68 g of hydrogen peroxide is dissolved in water to form an aqueous solution. The solution is heated and decomposed in the presence of manganese(IV) oxide to give 3.6 dm^3 of oxygen gas as follows.

$$2H_2O_2 \rightarrow O_2 + 2H_2O$$

What is the percentage purity of hydrogen peroxide?

A 2.5% **B** 5.0% **C** 10.0% **D** 15.0%

12 Which two oxides will react with sodium hydroxide solution?

A calcium oxide and zinc oxide

B phosphorus(III) oxide and lead(II) oxide

C copper(II) oxide and sulfur dioxide

D sulfur dioxide and magnesium oxide

13 Which statement about the reaction between ammonium carbonate and dilute hydrochloric acid is **false**?

A Ammonium chloride is produced.

B Ammonia gas is produced.

C The gas evolved turned damp blue litmus paper red.

D Water is produced.

14 Which salt can be prepared by adding excess carbonate to dilute acid?

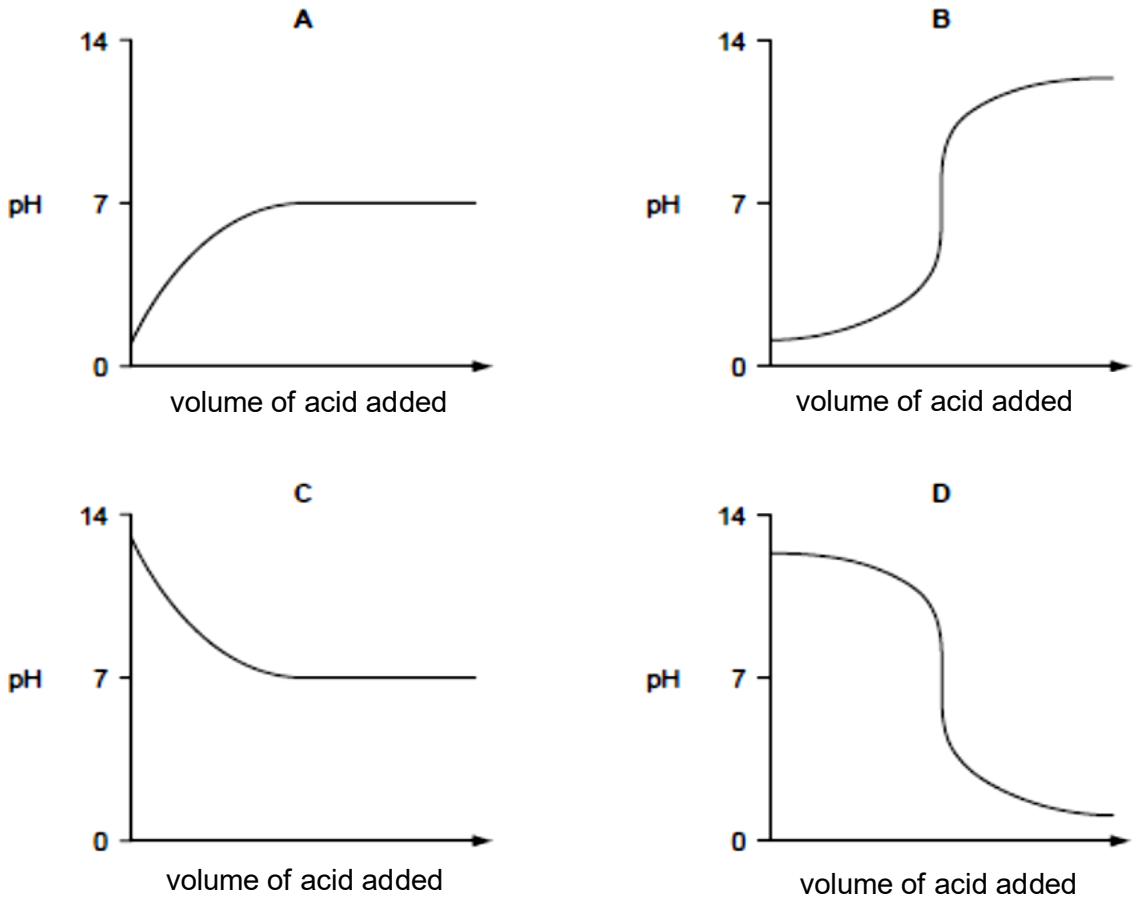
A lead(II) chloride

B magnesium chloride

C potassium nitrate

D sodium sulfate

15 Which graph shows the changes in pH as an excess of hydrochloric acid is added to aqueous sodium hydroxide?



16 Calcium nitrate solution is added to filtered tap water.

A white precipitate forms.

Which ion present in the tap water causes the precipitate to form?

A chloride

B magnesium

C potassium

D sulfate

17 Which statement about the manufacture of ammonia in the Haber process is **incorrect**?

A A 100% yield of ammonia will not be obtained in the reaction.

B High pressure is used to increase the yield of ammonia.

C Iron is used to increase the yield of ammonia.

D Nitrogen is obtained from fractional distillation of liquid air.

18 A solution of compound Z reacts with sodium hydroxide solution to form a white precipitate that is insoluble in excess sodium hydroxide solution.

Aluminium powder is then added. The mixture is heated and a gas that turns damp red litmus paper blue is given off.

What could the identity of Z be?

A aluminium chloride

B ammonium chloride

C calcium nitrate

D zinc nitrate

19 Which reagent could be used to distinguish between dilute sulfuric acid and dilute hydrochloric acid?

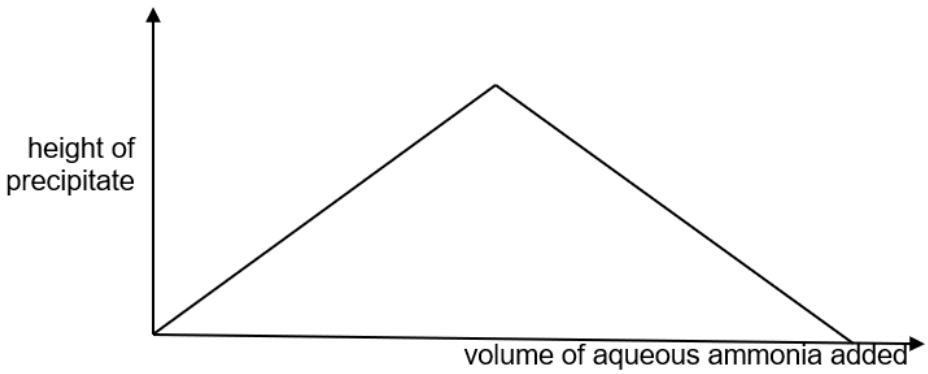
A barium nitrate solution

B calcium carbonate

C universal indicator

D sodium hydroxide solution

20 An aqueous solution of a salt is placed in a test-tube and aqueous ammonia is gradually added. The height in the test-tube is plotted against the volume of aqueous ammonia added.



What could the identity of this solution be?

A aluminium chloride

B calcium nitrate

C copper(II) chloride

D iron(II) sulfate

21 In an experiment, 10.0 cm^3 of 1.0 mol/dm^3 of aqueous iron(II) sulfate was mixed with 10.0 cm^3 of 1.0 mol/dm^3 of aqueous sodium hydroxide.

$$FeSO_4(aq) + 2NaOH(aq) \rightarrow Fe(OH)_2(s) + Na_2SO_4(aq)$$

What did the reaction flask contain when the reaction was complete?

A A green precipitate only.

B A green precipitate in a colourless solution.

C A white precipitate in a green solution.

D A green precipitate in a green solution.

22 In which substance does the sulfur atom have the same oxidation number as the sulfur atom in SO_2?

A H_2SO_4 **B** K_2SO_3 **C** Na_2S **D** $Na_2S_2O_3$

23 During electrolysis, 0.02 mol of chromium is deposited on the cathode when 0.08 mol of electrons is passes through a molten electrolyte containing chromium.

Which substance could be the electrolyte?

A $CrBr_2$

B $CrCl_4$

C Cr_2O_3

D $CrSO_4$

24 Three statements about fuel cells are given.

1 A hydrogen-oxygen fuel cell requires a continuous input of fuel and oxygen.

2 In a hydrogen-oxygen fuel cell, hydrogen is burned in oxygen to produce electricity.

3 When a hydrogen-oxygen fuel cell is operating, water is the only chemical product.

Which statements are correct?

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

25 Potassium, rubidium and sodium are in Group 1 of the Periodic Table.

Which statement about these three elements is correct?

A Rubidium is the strongest reducing agent.

B Sodium loses its valence electron most easily.

C Rubidium has a greater tendency to form negative ions than potassium.

D The reaction between sodium and water is the most violent.

26 Some properties of elements in Group 17 and the reasons for these properties are shown.

Which row correctly shows the reason for its corresponding property?

	property	reason
A	bromine displaces iodine from potassium iodide solution	iodine is more reactive than bromine
B	going down the group, the boiling point of the halogens increases	as molecular size increases, the intermolecular forces of attraction become stronger
C	going down the group, the oxidising property of the halogens decreases	as atomic size increases, it is more difficult for the atom to lose an electron
D	going down the group, the reactivity of the halogens decreases	as atomic size increases, it is more difficult for the nucleus to attract seven more electrons

27 Which statement about noble gases is **incorrect**?

A They are colourless gases at room temperature and pressure.

B They are insoluble in water.

C They are used to provide an inert atmosphere for processes like welding.

D They exist as diatomic molecules.

28 Which statement best supports that an unknown element could be a transition metal?

A The element burns in air to form a white residue.

B The element forms chlorides with the chemical formulae XCl_2 and XCl_3.

C The element forms ionic compounds that are soluble in water.

D The oxide of the element can react with acids.

29 The table below shows the reactions that manganese undergoes.

reaction with	observation
dilute acid	hydrogen gas produced
cold water	no visible reaction
steam	hydrogen gas is produced

Which row gives the correct arrangement of the metals in order of increasing reactivity?

A calcium, manganese, lead

B lead, calcium, manganese

C lead, manganese, calcium

D manganese, calcium, lead

30 The list shows the position of metal Y in the reactivity series of metals.

Na Al Zn Fe Y Cu Ag

Which methods could be used to extract metal Y from its oxide?

1 electrolysis of the molten metal oxide

2 heating the metal oxide with hydrogen

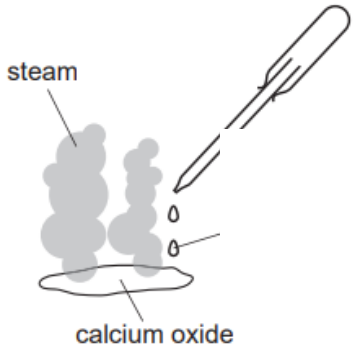
3 heating the metal oxide with zinc

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

31 The diagrams show four chemical reactions.

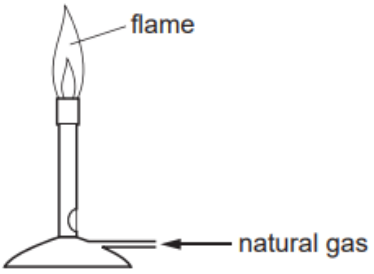
Which reaction is endothermic?

A



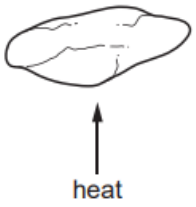
addition of water to calcium oxide

B



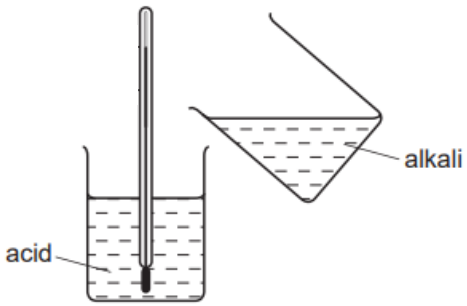
combustion of natural gas

C



thermal decomposition of limestone

D



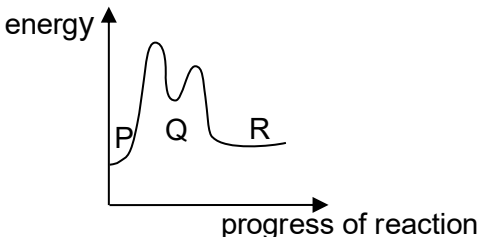
reaction of acid with alkali

32 In the conversion of compound P into compound R, it was found that the reaction proceeded by way of compound Q, which could be isolated. The steps involved were:

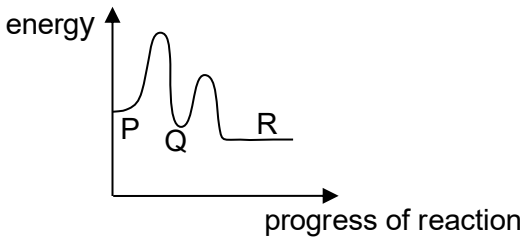
$P \rightarrow Q$; ΔH = negative
$Q \rightarrow R$; ΔH = positive

Which reaction profile agrees with this data?

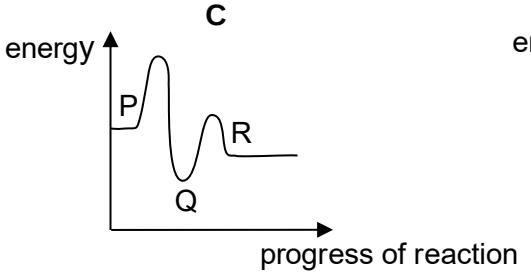
A



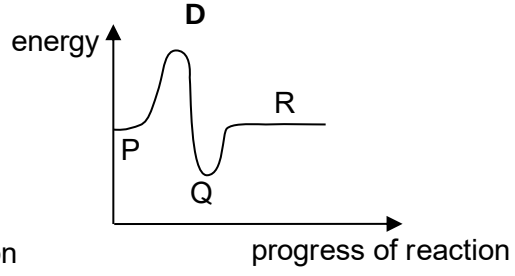
B



C



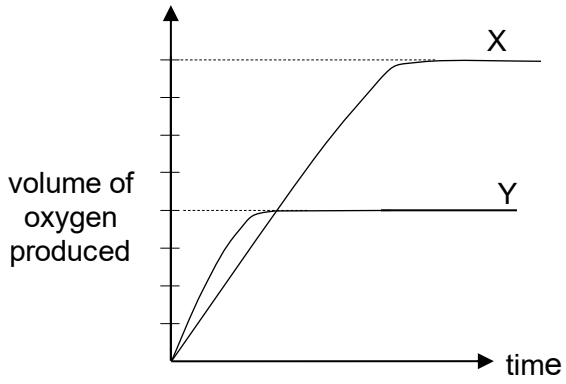
D



[Turn over

33 Graphs X and Y represent the results of two experiments demonstrating the catalytic decomposition of hydrogen peroxide.

Which set of values for hydrogen peroxide in each experiment would give the results shown?



	X		Y	
	volume (cm^3)	concentration (mol/dm^3)	volume (cm^3)	concentration (mol/dm^3)
A	50	2.0	100	1.0
B	100	1.0	50	2.0
C	100	1.0	200	0.5
D	400	0.5	100	1.0

34 In the fractional distillation of crude oil, different fractions are obtained at the top and bottom of the fractionating column.

Which properties do the fraction obtained at the top of the fractionating column have, compared with the fraction obtained at the bottom?

1 more viscous

2 burns more easily

3 lower boiling point

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

35 The complete combustion of 20 cm^3 of a gaseous alkane requires 100 cm^3 of oxygen. Both volumes are measured at room temperature and pressure.

What could be the identity of this alkane?

A butane

B ethane

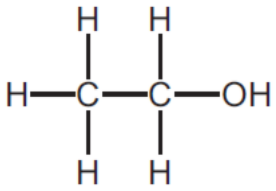
C methane

D propane

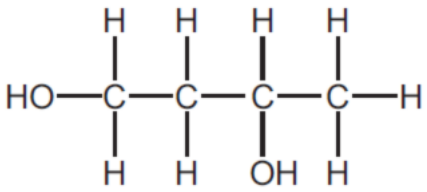
36 Compound W has the empirical formula C_2H_5O and decolourises acidified potassium manganate(VII).

Which structure(s) could be compound W?

1



2



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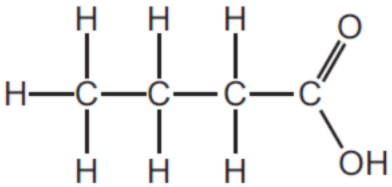

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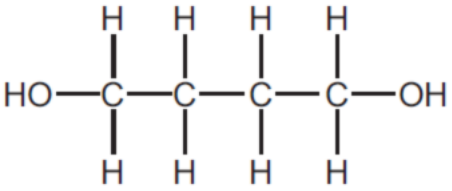
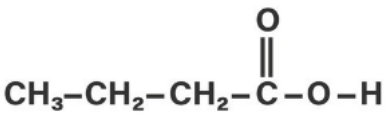


A 1 only **B** 3 only **C** 2 and 4 only **D** 1, 2 and 4

37 The diagrams show the structures of four organic molecules.

1



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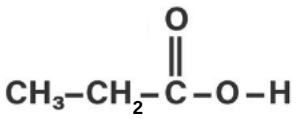

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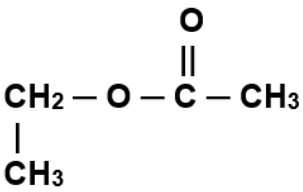

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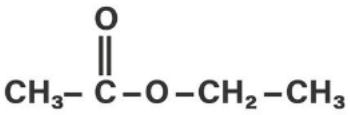


Which structures are isomers of one another?

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

38 The polymer, poly(ethene) is formed from its monomer, ethene.

What do poly(ethene) and ethene have in common?

1 chemical properties

2 empirical formula

3 percentage composition

4 relative molecular mass

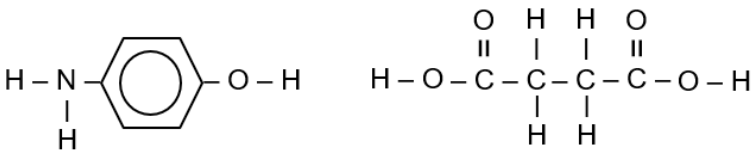
A 1 and 2 only

B 2 and 3 only

C 2 and 4 only

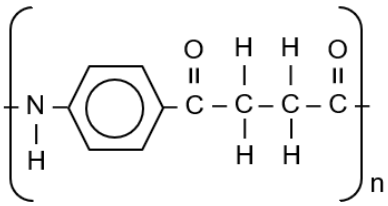
D 2, 3 and 4 only

39 The structure of two monomers are shown below.

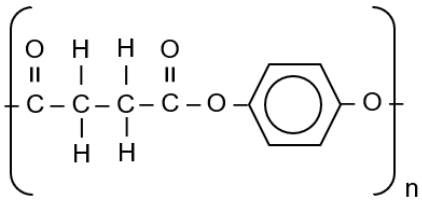


Which structure could be a polymer formed between the two monomers?

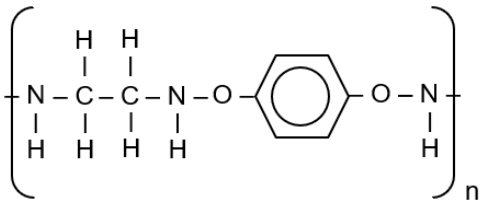
A



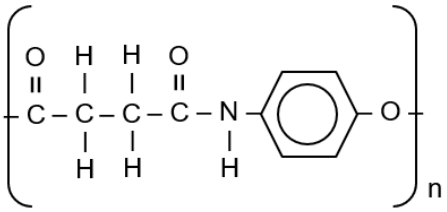
B



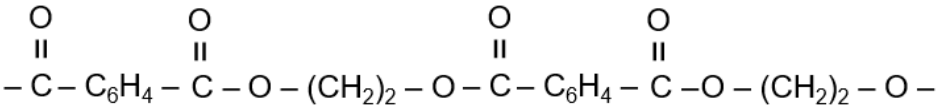
C



D



40 The polymer below is broken down into its monomers by hydrolysis using acid as a catalyst.



Which monomers are obtained from the hydrolysis reaction?

1 HOC_6H_4OH

2 $HOOC(CH_2)_2COOH$

3 $HO(CH_2)_2OH$

4 $HOOCC_6H_4COOH$

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

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		Key: proton (atomic) number / atomic symbol / name / relative atomic mass									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	3	4	5	6	7	8	9	10	11	12	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 –

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.).
The Avogadro constant, $L = 6.02 \times 10^{23}\ mol^{-1}$.