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CAMBRIDGE
International Education

Cambridge International AS & A Level

CHEMISTRY **9701/11**

Paper 1 Multiple Choice **May/June 2026**

1 hour 15 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)

1664026291

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 or tape.
- 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.
- Important values, constants and standards are printed in the question paper.

This document has **20** pages. Any blank pages are indicated.

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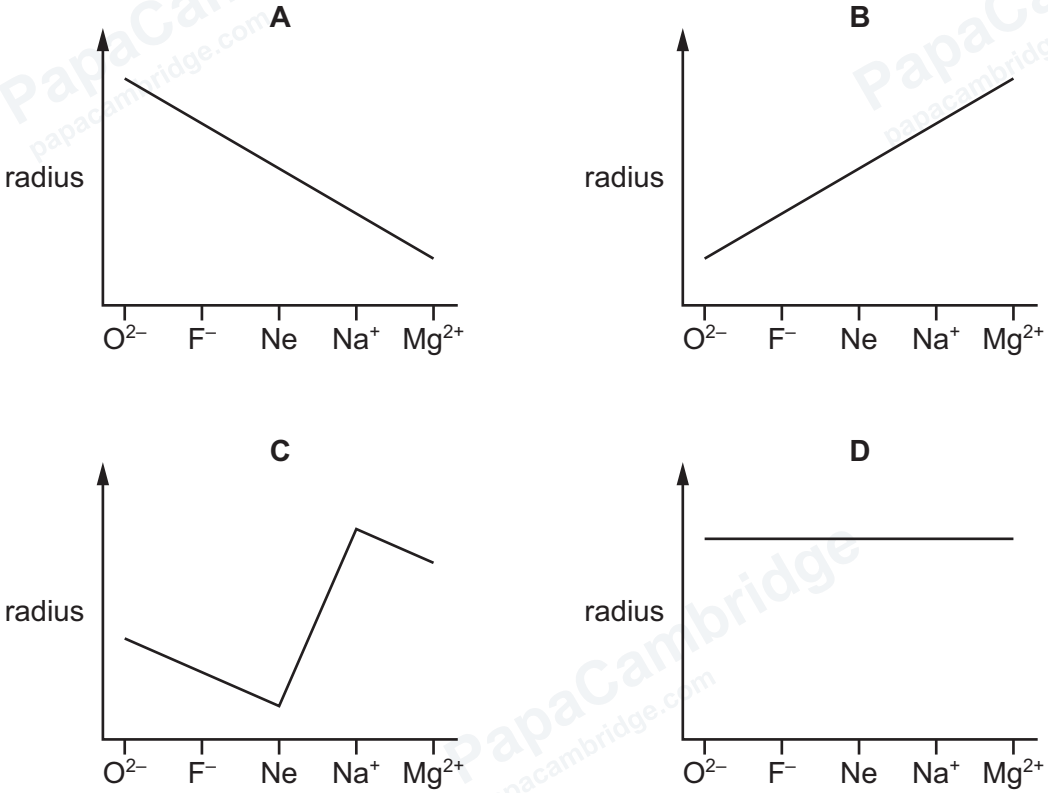
1 Which diagram shows the trend in radius for the five species?



2 Why is the first ionisation energy of sulfur lower than that of phosphorus?

A Sulfur is more electronegative than phosphorus.

B Sulfur forms anions more readily.

C In sulfur, the electron lost is paired with another electron.

D The sulfur atom is larger than the phosphorus atom.

3 Which statement is correct?

A The mass of the unified atomic mass unit is 12.0.

B The relative molecular mass of sodium chloride is 58.1.

C The relative formula mass of magnesium chloride is 95.3.

D The relative atomic mass of oxygen is 32.0.

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4 Which sample of gas has the smallest volume at room conditions?

A 17 g of ammonia

B 4 g of helium

C 4 g of hydrogen

D 35.5 g of chlorine

5 Which molecule or structure does **not** contain three atoms bonded at an angle between 109° and 110°?

A ethanoic acid

B graphite

C propane

D silicon(IV) oxide

6 Materials can be classified by their chemical structures. The four types of structure are metallic, ionic, simple molecular and giant molecular.

A, **B**, **C** and **D** all have different types of structure.

Which substance has a simple molecular structure?

	melting point / °C	**effect of adding water**	**electrical conductivity**
A	64	reacts	good when solid
B	113	insoluble	always poor
C	767	soluble	good when solid
D	1600	insoluble	always poor

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7 Elements X, Y and Z are all found in the first two periods of the Periodic Table.

Their Pauling electronegativity values are shown.

element	electronegativity
X	1.0
Y	2.1
Z	4.0

Substances exist with formulae XZ, YZ and Z_2.

Which row shows these substances in order of increasing melting point?

	lowest melting point	⟶	highest melting point
A	XZ	YZ	Z_2
B	XZ	Z_2	YZ
C	Z_2	YZ	XZ
D	Z_2	XZ	YZ

8 The equation for a reaction is shown.

$$C(s) + CO_2(g) \rightarrow 2CO(g)$$

This reaction has an enthalpy change of +172 kJ mol^{-1}.

Which deduction can be made from this information?

A Carbon can be used as a fuel by reacting it with carbon dioxide.

B The reaction $C(s) + CO_2(g) \rightarrow 2CO(g)$ absorbs heat from its surroundings.

C The standard enthalpy change of combustion of carbon is +172 kJ mol^{-1}.

D The standard enthalpy change of formation of CO is +86 kJ mol^{-1}.

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9 Sulfur can be oxidised to produce two different oxides.

$$S(s) + O_2(g) \rightarrow SO_2(g) \qquad \Delta H_f^{\ominus} = -297\,kJ\,mol^{-1}$$

$$S(s) + 1.5O_2(g) \rightarrow SO_3(g) \qquad \Delta H_f^{\ominus} = -395\,kJ\,mol^{-1}$$

What is the standard enthalpy change, $\Delta H^{\ominus}$, of the reaction $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$?

A $-196\,kJ\,mol^{-1}$ **B** $-98\,kJ\,mol^{-1}$ **C** $+98\,kJ\,mol^{-1}$ **D** $+196\,kJ\,mol^{-1}$

10 Which statement about the dichromate ion, $Cr_2O_7^{2-}$, is correct?

A It acts as an oxidising agent when it gains electrons.

B It is formed when the CrO_4^{2-} ion disproportionates into two chromium containing products.

C The oxidation number of chromium is +12.

D The sum of the oxidation numbers of all the chromium and oxygen atoms is zero.

11 The equation for the reaction between nitric acid and arsenous acid, H_3AsO_3, is shown.

$$x\,HNO_3 + y\,H_3AsO_3 \rightarrow x\,NO + y\,H_3AsO_4 + z\,H_2O$$

What are the numerical values of x and y?

	x	***y***
A	1	1
B	2	3
C	3	2
D	5	3

12 Nitrogen dioxide dissociates according to the equation shown.

$$2NO_2(g) \rightleftharpoons 2NO(g) + O_2(g)$$

When 0.75 mol of nitrogen dioxide is heated in a vessel of volume 9.80 dm^3 at 500 °C, 7.04 g of oxygen is found in the equilibrium mixture.

What is the value of K_c at this temperature?

A 3.84×10^{-3} **B** 0.0452 **C** 0.443 **D** 22.1

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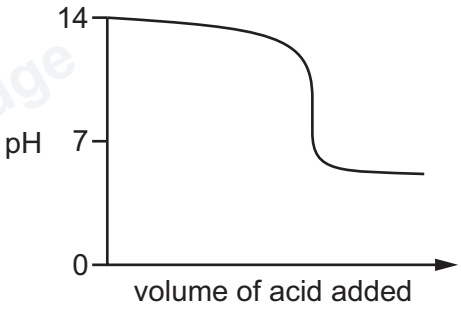
13 Which pH titration curve shows the result of a titration of a strong alkali with a weak acid?

A



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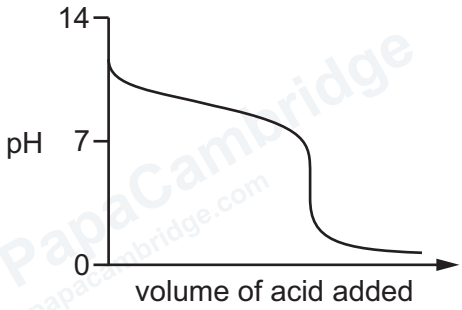

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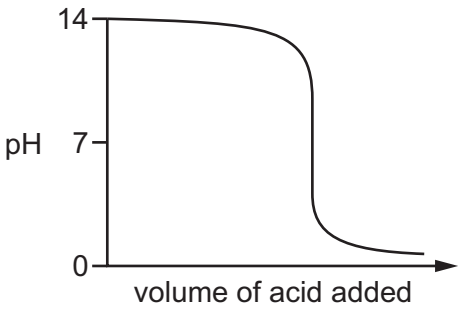

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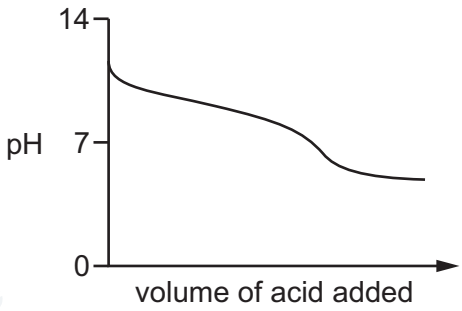

14 Nitrogen and hydrogen react to form ammonia in a reversible reaction.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 \qquad \Delta H = -92\,kJ\,mol^{-1}$$

A sealed reaction vessel contains a mixture of nitrogen, hydrogen and ammonia at equilibrium at 500 K. This mixture is put into a much larger sealed vessel. The temperature in this vessel is maintained at 300 K.

Which prediction can be made with certainty?

A Dynamic equilibrium will **not** re-establish.

B The position of equilibrium will **not** change.

C The rate of the forward reaction will increase.

D The rate of the backward reaction will decrease.

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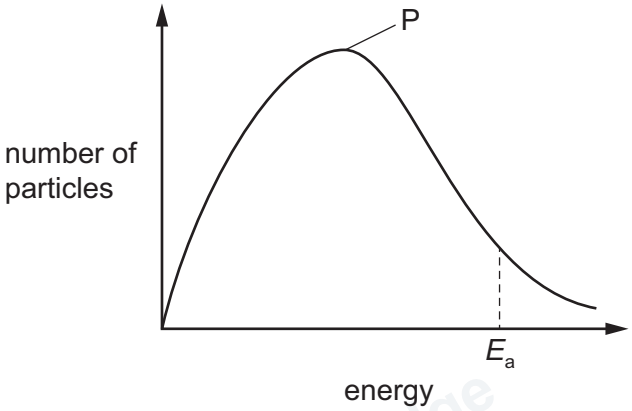
15 The diagram shows the Boltzmann distribution of energies in one mole of a gas. The gas takes part in a reaction with an activation energy, E_a.



Which statement correctly describes the effect of an increase in temperature?

A Peak P will be higher and fewer molecules will have energy > E_a.

B Peak P will be higher and more molecules will have energy > E_a.

C Peak P will be lower and fewer molecules will have energy > E_a.

D Peak P will be lower and more molecules will have energy > E_a.

16 Four different reactions occur.

1 $N_2(g)$ reacts with $O_2(g)$.

2 NaOH(aq) reacts with $NH_4Cl(aq)$.

3 $NH_3(aq)$ reacts with $HNO_3(aq)$.

4 $SO_2(g)$ reacts with $O_2(g)$.

Which reactions produce a basic soluble gas?

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

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17 The table contains some statements about Period 3 elements and their compounds.

In which row are both statements correct?

	statement 1	statement 2
A	the electronegativity of sodium is lower than that of sulfur	the pH of dissolved sodium oxide is lower than the pH of dissolved sulfur dioxide
B	the first ionisation energy of magnesium is lower than that of sodium	the melting point of magnesium oxide is higher than that of sodium oxide
C	the melting point of aluminium is higher than that of sodium	the melting point of aluminium chloride is lower than that of sodium chloride
D	the atomic radius of silicon is higher than that of sodium	the melting point of silicon chloride is lower than that of sodium chloride

18 Which statement explains why silicon has the highest melting point of the elements of Period 3?

A Each silicon atom contributes four delocalised electrons into its metallic structure.

B Silicon ions have the highest charge of the ions of the Period 3 elements.

C Silicon molecules have the strongest intermolecular forces of the Period 3 elements.

D Strong covalent bonds need to be broken for silicon to melt.

19 Which reaction produces the smallest total number of moles of gas?

[relative formula mass: $CaCO_3$, 100.1; $Sr(NO_3)_2$, 211.6; $BaCO_3$, 197.3]

A 3.60 g magnesium is added to 75.0 cm^3 of 3.00 mol dm^{-3} sulfuric acid

B 16.0 g calcium carbonate is added to 50.0 cm^3 of 4.80 mol dm^{-3} hydrochloric acid

C 10.6 g strontium nitrate is decomposed by heating

D 27.6 g barium carbonate is decomposed by heating

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20 Barium reacts with water to produce a colourless solution, V.

A sample of V is shaken with $MgCl_2(aq)$ to produce mixture W. An excess of $HCl(aq)$ is added to mixture W to produce mixture X.

A second sample of V is shaken with $MgSO_4(aq)$ to produce mixture Y. An excess of $HCl(aq)$ is added to mixture Y to produce mixture Z.

Observations of W, X, Y and Z are made when any reaction is complete.

In which of W, X, Y and Z is a white solid observed?

A W, X, Y and Z

B W, Y and Z only

C W and Y only

D X, Y and Z only

21 Which statement is correct?

A Bromide ions react to form a white precipitate when added to silver nitrate solution.

B Bromine does **not** oxidise chloride ions when added to sodium chloride solution.

C Fluorine atoms form cations by accepting electrons when they react.

D Chloride ions are stronger reducing agents than iodide ions.

22 Chlorine reacts separately with water, cold aqueous sodium hydroxide and hot aqueous sodium hydroxide.

Which statement about these reactions is correct?

A Cl^- ions are formed in two of these reactions only.

B Chlorine reacts with hot NaOH(aq) to form $HClO_3$.

C Chlorine reacts with water to form $HOCl$.

D Chlorine reacts with cold NaOH(aq) to form $NaClO_2$.

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23 Halide ion X^- reacts with concentrated sulfuric acid.

Among the products of the reaction is a sulfur-containing compound in which the oxidation number of the sulfur is –2.

Which halide ion is X^-?

A chloride ion or bromide ion

B chloride ion only

C bromide ion or iodide ion

D iodide ion only

24 The table gives information about the bonding in different species.

Which row is correct?

	species	total number of bonding electrons in the outer shells of all atoms	total number of non-bonding electrons in the outer shells of all atoms
A	nitrogen molecule	6	2
B	ammonia molecule	8	2
C	ammonium ion	8	0
D	hydroxide ion	2	8

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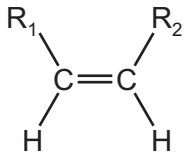
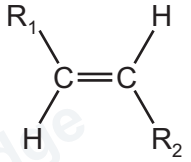
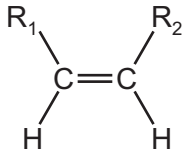
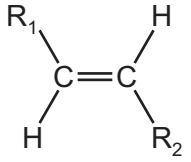
25 The formula of 11-*cis*-retinal is $C_{20}H_{28}O$.

The structure of 11-*cis*-retinal consists of a cyclohexene ring and a long aliphatic side chain ending in an aldehyde group. The long aliphatic side chain contains one or more C=C bonds. One C=C bond is between carbons numbered 11 and 12. The arrangement is cis at this point.

Which row is correct?

	total number of >C=C< double bonds	**arrangement around the adjacent carbons 11 and 12**
A	5	
B	5	
C	6	
D	6	

26 Which compound has the empirical formula CH_2O?

A butane-2,3-diol

B ethanol

C methyl methanoate

D propanoic acid

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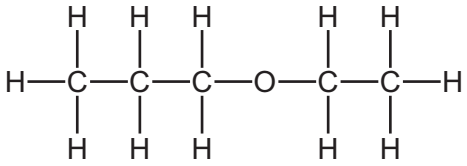
27 The structure of an ether X is shown. The C–O–C group is the functional group in the homologous series of ethers.



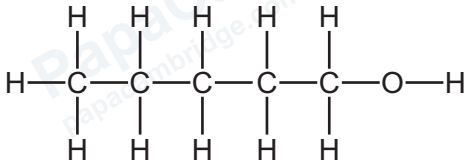
X

Y is a functional group isomer of X.

Y exists as a pair of optical isomers.

Which structure represents Y?

A



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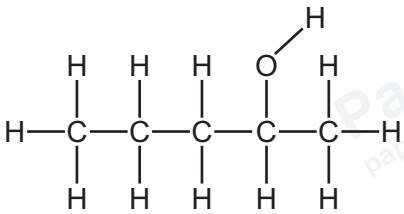

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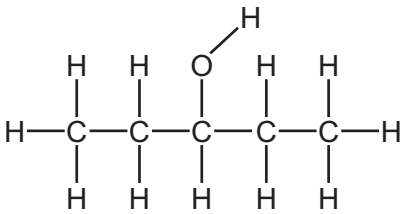
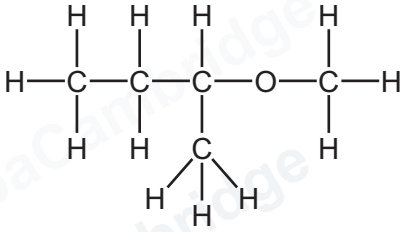


D



28 This question is about the conversion of but-2-ene to butanone.

What are the correct steps to carry out this conversion?

A adding hot concentrated acidified $KMnO_4$ and heating the mixture under reflux

B heating with steam using an H_3PO_4 catalyst followed by heating under reflux with acidified $K_2Cr_2O_7$

C adding hydrogen bromide followed by boiling the mixture with NaOH(aq)

D heating with acidified $K_2Cr_2O_7$ followed by distillation

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29 Which compound will decolourise $Br_2(aq)$ in the dark?

A $CH_3CH_2CH_2CH_2CH_2CO_2H$

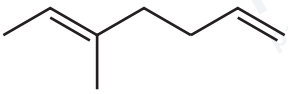
B $CH_3CH_2CHOHCH_2CH_2CH_3$

C $CH_3CHCHCH_2CH_2CH_2OH$

D $CH_3CH_2CH_2CO_2CH_2CH_3$

30 The structure of compound Z is shown.

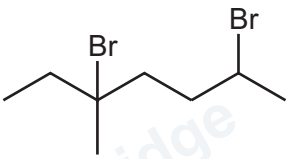
compound Z



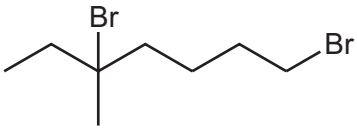
One mole of compound Z reacts completely with two moles of hydrogen bromide.

What is the structure of the major product of this reaction?

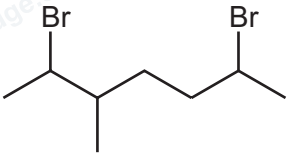
A



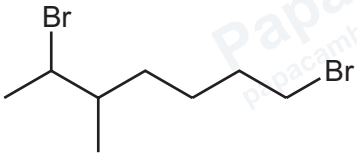
B



C



D



31 Structural isomerism and stereoisomerism should be taken into account when answering this question.

A sample of 2-bromobutane is strongly heated in a concentrated ethanolic solution of sodium hydroxide.

How many isomeric organic products are formed?

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

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32 Which organic reaction has a nucleophilic substitution mechanism?

A $CH_3CH_2Br + NaOH \rightarrow CH_3CH_2OH + NaBr$

B $CH_3CH_2Br + NaOH \rightarrow CH_2CH_2 + NaBr + H_2O$

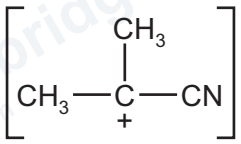
C $C_2H_4 + HCl \rightarrow C_2H_5Cl$

D $C_2H_6 + Cl_2 \rightarrow C_2H_5Cl + HCl$

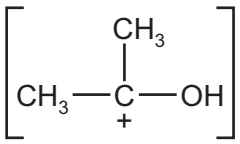
33 When an acidified aqueous solution of potassium cyanide is added to propanone, an addition reaction takes place.

Which structure shows the intermediate formed during this reaction?

A



B



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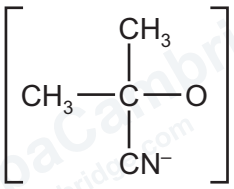

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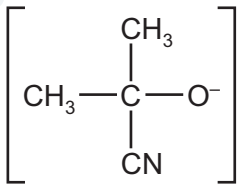

34 The structural formulas of four isomers of $C_5H_{10}O$ are listed.

- $CH_3CH(OH)CH_2CH{=}CH_2$
- $(CH_3)_3CCHO$
- $CH_3COCH_2CH_2CH_3$
- $(CH_3)_2CHCOCH_3$

Structural isomerism only should be taken into account when answering this question.

Which row is correct?

	the number of these isomers that give a precipitate with 2,4-DNPH	**the number of these isomers that give a precipitate with alkaline I_2(aq)**
A	2	2
B	2	3
C	3	2
D	3	3

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35 Which reaction has ethanoic acid as one of the products?

A CH_3CN is heated with dilute alkali under reflux.

B CH_3CH_2CN is heated with dilute acid under reflux.

C CH_3COOCH_3 is heated with dilute alkali under reflux.

D $CH_3COOCH_2CH_2CH_3$ is heated with dilute acid under reflux.

36 Primary alcohols are produced from carboxylic acids.

$$RCOOH + 4[H] \rightarrow RCH_2OH + H_2O$$

Which statement about this reaction is correct?

A $LiAlH_4$ reduces RCOOH to RCH_2OH, but $NaBH_4$ does **not**.

B $LiAlH_4$ and $NaBH_4$ will each reduce RCOOH to RCH_2OH.

C $LiAlH_4$ and $NaBH_4$ will each hydrolyse RCOOH to RCH_2OH.

D $LiAlH_4$ hydrolyses RCOOH to RCH_2OH, but $NaBH_4$ does **not**.

37 Three equations are shown.

1 $CH_3COOH + MgCO_3 \rightarrow CH_3COOMg + CO_2 + H_2O$

2 $CH_3CH_2COOH + Na \rightarrow CH_3CH_2COONa + 0.5H_2$

3 $CH_3CH_2COOH + 2Ba(OH)_2 \rightarrow CH_3CH_2COOBa_2 + 2H_2O$

Which of the equations are correct?

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

38 Which fragment could appear in the chain produced by polymerising 1,1-dichloroethene?

A $-CH_2-CH_2-CCl_2-CCl_2-CH_2-CH_2-$

B $-CHCl-CHCl-CHCl-CHCl-CHCl-CHCl-$

C $-CH_2-CCl_2-CH_2-CH_2-CH_2-CCl_2-$

D $-CCl_2-CCl_2-CH_2-CH_2-CH_2-CCl_2-$

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39 A sample of 2.76 g of ethanol was mixed with an excess of aqueous acidified potassium dichromate(VI). The reaction mixture was then heated under reflux for one hour. The required organic product was then collected by distillation.

The yield of product was 75.0%.

Which mass of product was collected?

A 1.26 g **B** 1.98 g **C** 2.07 g **D** 2.70 g

40 The infrared spectrum of X shows absorptions at 2200 cm^{-1} and 1630 cm^{-1}.

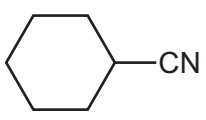
The mass spectrum of X shows:

- a peak for the molecular ion, X^+, with a relative abundance of 38
- a peak for the ion, $[X+1]^+$, with a relative abundance of 2.9.

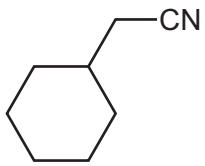
bond	functional groups containing the bond	characteristic infrared absorption range (in wavenumbers) / cm^{-1}
C–O	hydroxy, ester	1040–1300
C=C	aromatic compound, alkene	1500–1680
C=O	amide carbonyl, carboxyl ester	1640–1690 1670–1740 1710–1750
C≡N	nitrile	2200–2250
C–H	alkane	2850–2950
N–H	amine, amide	3300–3500
O–H	carboxyl hydroxy	2500–3000 3200–3650

What is a possible structure of X?

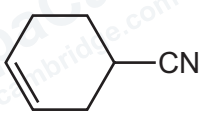
A



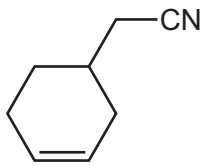
B



C



D



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Important values, constants and standards

molar gas constant	$R = 8.31\,\text{J K}^{-1}\,\text{mol}^{-1}$
Faraday constant	$F = 9.65 \times 10^{4}\,\text{C mol}^{-1}$
Avogadro constant	$L = 6.022 \times 10^{23}\,\text{mol}^{-1}$
electronic charge	$e = -1.60 \times 10^{-19}\,\text{C}$
molar volume of gas	$V_m = 22.4\,\text{dm}^3\,\text{mol}^{-1}$ at s.t.p. (101 kPa and 273 K) $V_m = 24.0\,\text{dm}^3\,\text{mol}^{-1}$ at room conditions
ionic product of water	$K_w = 1.00 \times 10^{-14}\,\text{mol}^2\,\text{dm}^{-6}$ (at 298 K (25 °C))
specific heat capacity of water	$c = 4.18\,\text{kJ kg}^{-1}\,\text{K}^{-1}$ ($4.18\,\text{J g}^{-1}\,\text{K}^{-1}$)

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The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1.0										2 He helium 4.0
3 Li lithium 6.9	4 Be beryllium 9.0											5 B boron 10.8	6 C carbon 12.0	7 N nitrogen 14.0	8 O oxygen 16.0	9 F fluorine 19.0	10 Ne neon 20.2
11 Na sodium 23.0	12 Mg magnesium 24.3	3	4		6	7	8	9	10	11	12	13 Al aluminium 27.0	14 Si silicon 28.1	15 P phosphorus 31.0	16 S sulfur 32.1	17 Cl chlorine 35.5	18 Ar argon 39.9
19 K potassium 39.1	20 Ca calcium 40.1	21 Sc scandium 45.0	22 Ti titanium 47.9	23 V vanadium 50.9	24 Cr chromium 52.0	25 Mn manganese 54.9	26 Fe iron 55.8	27 Co cobalt 58.9	28 Ni nickel 58.7	29 Cu copper 63.5	30 Zn zinc 65.4	31 Ga gallium 69.7	32 Ge germanium 72.6	33 As arsenic 74.9	34 Se selenium 79.0	35 Br bromine 79.9	36 Kr krypton 83.8
37 Rb rubidium 85.5	38 Sr strontium 87.6	39 Y yttrium 88.9	40 Zr zirconium 91.2	41 Nb niobium 92.9	42 Mo molybdenum 95.9	43 Tc technetium –	44 Ru ruthenium 101.1	45 Rh rhodium 102.9	46 Pd palladium 106.4	47 Ag silver 107.9	48 Cd cadmium 112.4	49 In indium 114.8	50 Sn tin 118.7	51 Sb antimony 121.8	52 Te tellurium 127.6	53 I iodine 126.9	54 Xe xenon 131.3
55 Cs caesium 132.9	56 Ba barium 137.3	57–71 lanthanoids	72 Hf hafnium 178.5	73 Ta tantalum 180.9	74 W tungsten 183.8	75 Re rhenium 186.2	76 Os osmium 190.2	77 Ir iridium 192.2	78 Pt platinum 195.1	79 Au gold 197.0	80 Hg mercury 200.6	81 Tl thallium 204.4	82 Pb lead 207.2	83 Bi bismuth 209.0	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 138.9	58 Ce cerium 140.1	59 Pr praseodymium 140.9	60 Nd neodymium 144.2	61 Pm promethium –	62 Sm samarium 150.4	63 Eu europium 152.0	64 Gd gadolinium 157.3	65 Tb terbium 158.9	66 Dy dysprosium 162.5	67 Ho holmium 164.9	68 Er erbium 167.3	69 Tm thulium 168.9	70 Yb ytterbium 173.1	71 Lu lutetium 175.0
actinoids	89 Ac actinium –	90 Th thorium 232.0	91 Pa protactinium 231.0	92 U uranium 238.0	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 –

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