CHRIST CHURCH SECONDARY SCHOOL
2025 PRELIMINARY EXAMINATION
SECONDARY FOUR EXPRESS

CANDIDATE NAME		CLASS	
CENTRE NUMBER	S	INDEX NUMBER	

CHEMISTRY

6092/01

Paper **1**

26 August 2025

1 hour

Candidates answer on the Question Paper
Additional Materials: OTAS Paper

READ THESE INSTRUCTIONS FIRST

Write your Centre number, index number, name and class on all the work you hand in.
Write in soft pencil on the Multiple Choice Answer Sheet
Do not use staples, paper clips, glue or correction fluid.

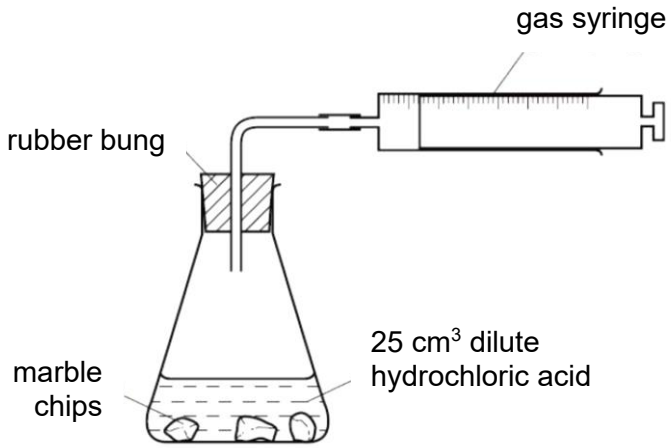
There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A**, **B**, **C** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Multiple Choice Answer Sheet.

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 in this booklet.
A copy of the Periodic Table is printed on page 16.
The use of an approved scientific calculator is expected, where appropriate.

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1 The apparatus shown in the diagram below was set up by a student to measure the volume of carbon dioxide gas made when different masses of marble chips were added to 25 cm^3 of dilute hydrochloric acid.



Which other apparatus did he use for his experiment?

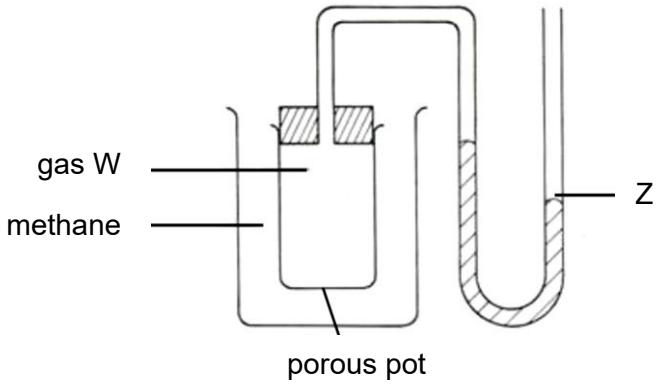
A filter funnel and mass balance

B filter funnel and stopwatch

C measuring cylinder and mass balance

D measuring cylinder and stopwatch

2 Gas W was collected using displacement of air by downward delivery, and then placed in the set-up below. After a short while, the water level in column Z was observed.



Which observations(s) could possibly be made about the water level in column Z?

I Water level increased.
II Water level remained the same.
III Water level decreased, then increased.

A I only

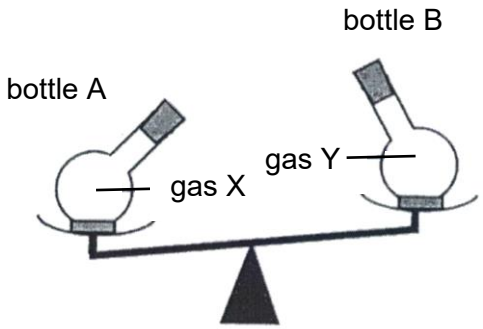
B II only

C I and II

D II and III

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3 Two identical bottles, A and B are filled with gases X and Y respectively. They were then put on a balance at room temperature and pressure. The result is shown below



Which of the following statements is **correct**?

A The number of gas particles in bottle A is greater than the number of gas particles in bottle B.

B The number of moles of gas particles in bottle A is greater than the number of moles of gas particles in bottle B.

C The molar mass of gas particles in bottle A is greater than the molar mass of gas particles in bottle B.

D The molar volume of gas particles in bottle A is greater than the molar volume of gas particles in bottle B.

4 The boiling points of some gases present in air are given in the table below.

gas	nitrogen	oxygen	argon	xenon
boiling point / ^{o}C	-196	-182	-186	-108

A mixture containing liquefied air at -200 ^{o}C is fractionally distilled.

Which one of the following would still remain as a liquid when the temperature is increased by 15 ^{o}C?

A nitrogen and argon

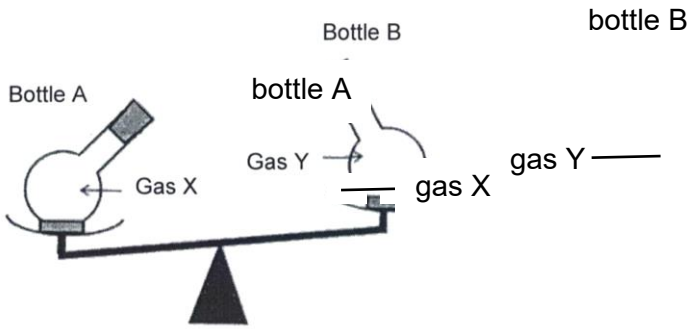
B oxygen and argon

C oxygen and xenon

D argon, oxygen and xenon

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D The molar volume of gas particles in bottle A is greater than the molar volume of gas particles in bottle B.

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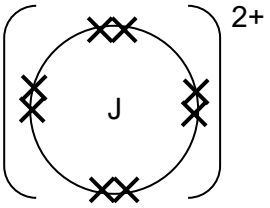
B oxygen and argon

C oxygen and xenon

D argon, oxygen and xenon

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5 J is an element found in the Periodic Table.



Which of the following **cannot** be deduced from the information provided only?

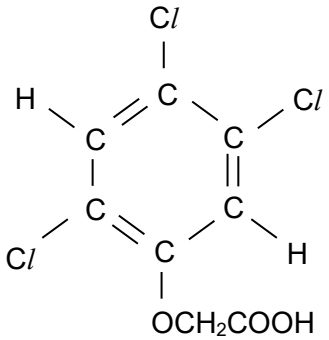
A Element J can likely be found in Group 2 of the Periodic Table.

B Element J has two isotopes that have different physical properties.

C The atomic radius of J is bigger than its ionic radius.

D The ion of J can be attracted to any oppositely charged ion.

6 The figure below shows a molecule of an herbicide called 2,4,5-T which is often used for weed control.



How many pairs of shared electrons are present in one molecule of the herbicide?

A 12 **B** 15

C 20 **D** 23

7 In which of the following molecules are all the outer electrons of the atoms involved in bonding?

A CH_4 **B** CO_2

C NH_3 **D** HCl

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8 The table below shows the information about the chlorides of some elements in Period 3 of the Periodic Table.

element	formula of main chloride	bonding present in chloride	pH of resulting solution when dissolved in water
sodium	NaC*l*	ionic	7
magnesium	$MgCl_2$	ionic	7
aluminium	$AlCl_3$	covalent	3
phosphorus	PCl_3	covalent	2
sulfur	S_2Cl_2	covalent	2

What will be the bonding present in the chloride of silicon and the pH value of the resulting solution when the chloride is dissolved in water?

	bonding present in chloride	pH of resulting solution when dissolved in water
A	covalent	2
B	covalent	7
C	ionic	2
D	ionic	7

9 The table below shows some physical properties of substances P, Q, R and S.

substance	melting point / °C	electrical conductivity	
		in solid state	in molten state
P	high	poor	good
Q	high	good	good
R	high	poor	poor
S	low	poor	poor

Which of the following statements is **true** about substances P, Q, R and S?

A Substance P contains mobile electrons to conduct electricity when in molten state.

B Substance Q consists of strong electrostatic attractions between oppositely charged particles.

C Substance R consists of weak bonds between the atoms.

D Substance S exists in a simple molecular structure.

10 Which of the following is **true** of graphite and copper?

A They both contain strong forces of attraction between oppositely charged ions.

B They both have giant covalent structure.

C They can conduct electricity in the solid state due to mobile delocalised electrons.

D They have high melting points due to strong covalent bonds.

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11 Compound X is made up of two elements, metal Y and non-metal Z. Compound X has a giant lattice structure where each negative ion is surrounded by four positive ions while each positive ion is surrounded by eight negative ions.

Which of the following shows the correct formula of the ions present in compound X, as well as the chemical forumla of compound X?

	cation	anion	chemical formula
A	Y^+	Z^{2-}	Y_2Z
B	Y^{2+}	Z^-	YZ_2
C	Z^+	Y^{2-}	Z_2Y
D	Z^{2+}	Y^-	ZY_2

12 An unknown carbonate, M_2CO_3, is heated and the following reaction takes place.

$$M_2CO_3 \rightarrow M_2O(s) + CO_2(g)$$

Which volume of carbon dioxide, at r.t.p, would be produced if *z* g of M_2CO_3, which has relative molecular mass *y*, is heated?

A $\frac{y}{24z}$ dm^3

B $\frac{24y}{z}$ dm^3

C $\frac{24z}{y}$ dm^3

D $\frac{44z}{y}$ dm^3

13 Red cabbage can be used as a pH indicator. The indicator prepared from red cabbage changes colour according to the following pH ranges shown in the table below.

pH	colour
<7	red
7	purple
8-9	blue
10-11	green
11-13	yellow

Which two solutions could **not** be distinguished using the red cabbage indicator?

A aqueous solutions of ammonia and sodium hydroxide

B aqueous solutions of hydrogen chloride and sulfurous acid

C aqueous solutions of potassium hydroxide and potassium nitrate

D distilled water and limewater

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14 The table below shows the results of different experiments conducted on two acids, A1 and A2, of equal concentration.

acids	conductivity of acid solution / arbitrary units	temperature change when excess acid was reacted with 0.1 mol of sodium hydroxide / °C	observation when reacted with 3.0 cm magnesium strip
A1	1000	+6.9	rapid effervescence of a colourless gas
A2	7	+6.7	slow bubbling of a colourless gas

Which of the following deductions can be made about acids A1 and A2?

A A1 is a weak acid while A2 is a strong acid.

B A1 is a strong acid while A2 is a weak acid.

C Both A1 and A2 are weak acids, except that A1 is a dibasic acid.

D Both A1 and A2 are strong acids, except that A2 is a dibasic acid.

15 Zinc carbonate granules were added into a mixture of hydrogen chloride gas dissolved in an organic solution called benzene. No reaction was observed.

Which of the following changes could be made so that the zinc carbonate would react with the hydrogen chloride gas?

A Add more hydrogen chloride gas.

B Change the benzene solvent to water.

C Crush the zinc carbonate into powdered form.

D Heat the reaction mixture.

16 In which reaction is dilute hydrochloric acid **not** behaving as an acid?

A $HCl(aq) + AgNO_3(aq) \rightarrow AgCl(s) + HNO_3(aq)$

B $HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$

C $2HCl(aq) + CuO(s) \rightarrow CuCl_2(aq) + H_2O(l)$

D $2HCl(aq) + Mg(s) \rightarrow MgCl_2(aq) + H_2(g)$

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17 Which of the following statements about the Haber process is **incorrect**?

A At the optimum conditions, the yield of ammonia is 100%.

B Higher pressure produces a higher percentage yield of ammonia.

C Nitrogen is obtained as a raw material from the fractional distillation of liquid air.

D The pressure in the reaction chamber is increased to speed up the reaction.

18 The reaction in the Haber process is represented by the equation below.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ kJ}$$

Which of the following statements is **incorrect**?

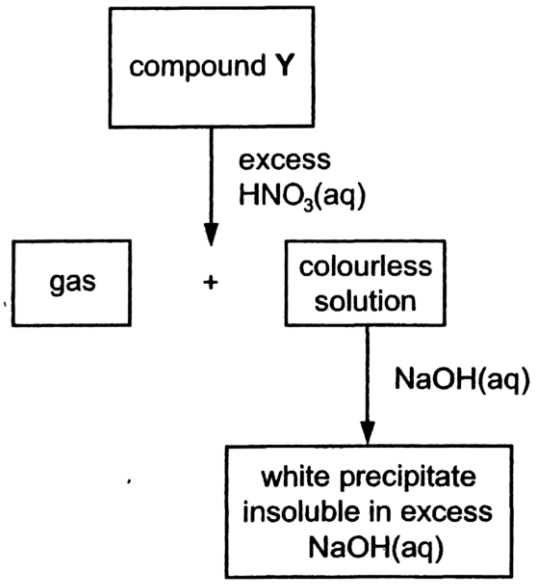
A 92 kJ of heat is given off when 2 moles of ammonia are formed.

B Iron catalyst affects the enthalpy change.

C The process is carried out at a high pressure of 250 atm.

D When 2 moles of nitrogen and 6 moles of hydrogen are used, 4 moles of ammonia will be collected.

19 The scheme shows some reactions of a compound Y.



What could the compound Y be?

A aluminium sulfate

B calcium carbonate

C copper(II) carbonate

D zinc sulfate

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20 An excess of sodium hydroxide is added to an aqueous solution of salt L and boiled. Ammonia gas is observed to be produced only after a piece of aluminium foil is added to the hot solution.

What could be salt L?

A ammonium chloride

B ammonium nitrate

C sodium chloride

D sodium nitrate

21 Which of the following ions have the highest concentration in solution when a few drops of aqueous ammonia are added into aqueous copper(II) sulfate?

A Cu^{2+} **B** NH_4^+

C OH^- **D** SO_4^{2-}

22 Which of the following shows a redox reaction?

A acid reaction with a metal oxide

B displacement reaction

C precipitation reaction using two soluble salts

D titration between acids and alkalis

23 In which of the following pairs of compounds do the two underlined elements have the same oxidation state?

A $\underline{Cr}O_3$ and $KC\underline{l}O_3$

B $\underline{Cu}C\underline{l}_2$ and $\underline{Na}_2CO_3$

C $K\underline{Mn}O_4$ and $K_2\underline{Cr}_2O_7$

D $\underline{Mn}SO_4$ and $\underline{Fe}SO_4$

24 Three electrolysis cells are set up with inert electrodes. The electrolytes used for each cell are listed below.

1 concentrated hydrochloric acid
2 molten aluminium bromide
3 aqueous potassium nitrate

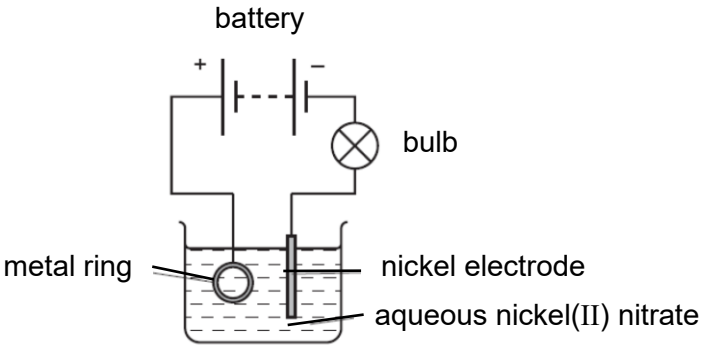
Which of the cell(s) above will have a gas formed at **both** its electrodes?

A 2 only **B** 3 only

C 1 and 2 **D** 1 and 3

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25 The diagram shows the apparatus used to electroplate a metal ring with nickel.



The experiment did not work.

Which change is needed in the experiment to make it work?

A Add molten nickel(II) nitrate to the electrolyte.

B Increases the temperature of the electrolyte.

C Reverse the connection to the battery.

D Swap the nickel electrode with a platinum electrode.

26 Which of the following statements about Group 17 elements are **true**?

I They form diatomic molecules because they have the same number of valence electrons.

II They have increasing density down the group.

III Their strength as oxidising agents increases down the group.

A I only

B I and II only

C II and III only

D I, II and III

27 Which of the following rows of properties is **correct** for both copper and sodium?

	property	copper	sodium
A	density / g cm^{-3}	8.92	0.97
B	colour	blue	white
C	melting point / °C	810	1083
D	nature of oxide	amphoteric	basic

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28 The solid carbonate of three metals W, X and Y are heated, and the results are recorded in the table below.

carbonate of metal	result
W	carbon dioxide produced; solid turns from green to black
X	carbon dioxide produced; solid does not change colour
Y	carbon dioxide not produced; solid does not change colour

The conclusions below were made by a student.

1 Metal W could be used as a catalyst.
2 Metal Y is a stronger reducing agent than metal X.
3 Only the carbonates of metals W and X produce carbon dioxide when added to dilute nitric acid.

Which of the above statements are correct?

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

29 Which of the following metals requires the **least** energy to be extracted from its ore?

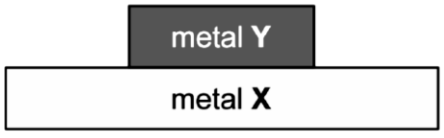
A calcium

B copper

B iron

D lead

30 Metals can be protected against corrosion by sacrificial protection.
The diagram below shows metal X being protected from corrosion by metal Y.



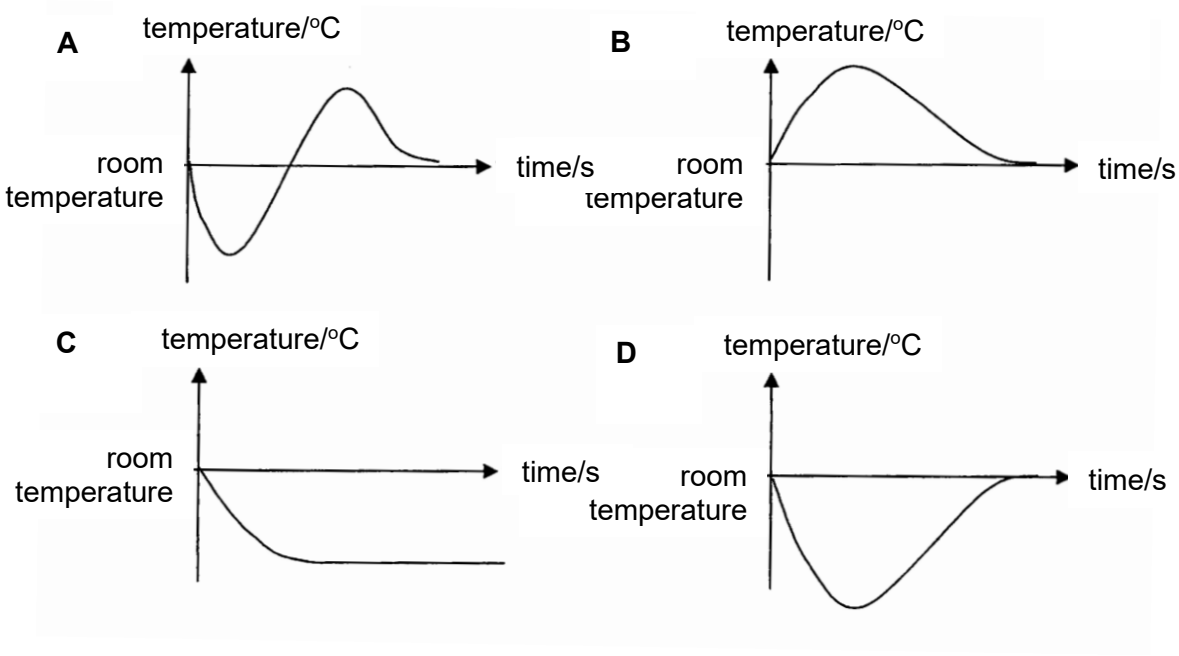
What could be the possible identities of metals X and Y?

	metal X	**metal Y**
A	copper	gold
B	lead	silver
C	magnesium	iron
D	zinc	calcium

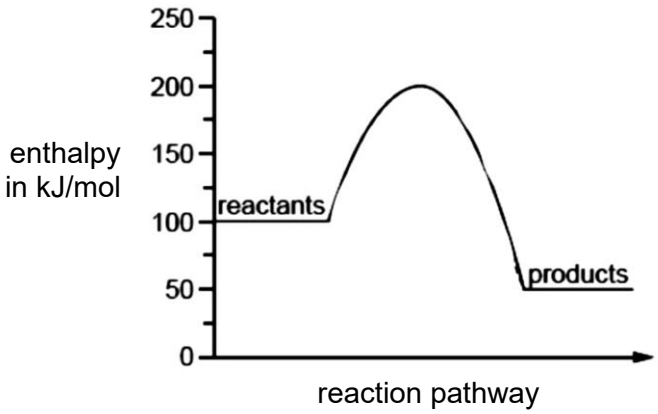
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31 The process of dissolving potassium iodide in water is endothermic.

Which of the following graphs shows the temperature changes that occur when potassium iodide is stirred with water until no further change in temperature is observed?



32 The energy diagram below represents the energy changes in a chemical reaction.



What is the enthalpy change of this reaction?

A +50 kJ **B** -50 kJ

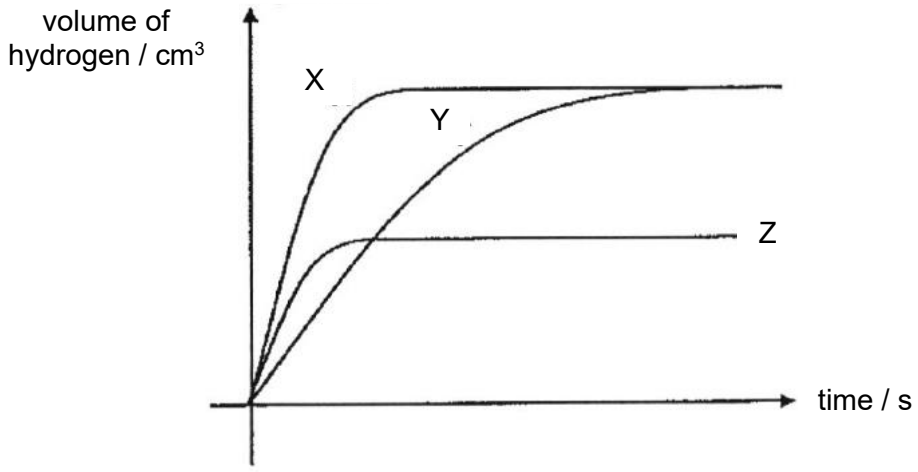
C +100 kJ **D** -100 kJ

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33 A student performed three experiments to produce hydrogen gas using excess zinc carbonate and dilute sulfuric acid at 30 °C.

experiment	zinc carbonate	dilute sulfuric acid	
	particle size	volume / cm^3	concentration / mol dm^{-3}
1	powdered	20	1.00
2	lumps	40	0.50
3	lumps	10	1.00

Three graphs were plotted for the volume of hydrogen produced against time.



Which graph best represents each of the respective three experiments?

	experiment 1	experiment 2	experiment 3
A	X	Y	Z
B	Y	X	Z
C	Y	Z	X
D	Z	X	Y

34 Which of the following best explains why bioethanol obtained from sugarcane plants is considered renewable?

A Sugarcane plants can be harvested after one year.

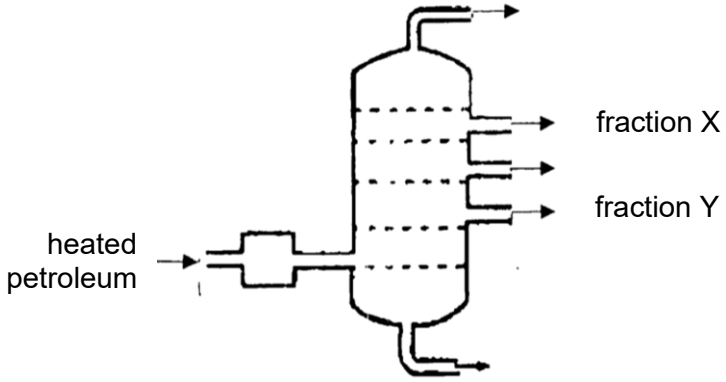
B Sugarcane plants require carbon dioxide during photosynthesis.

C The sugar from sugarcane plants can be transported from one place to another.

D The sugar from sugarcane plants can undergo fermentation.

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35 The diagram shows the fractional distillation of petroleum.

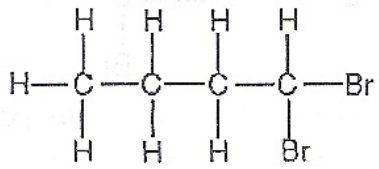


Which statements about fractions X and Y are correct?

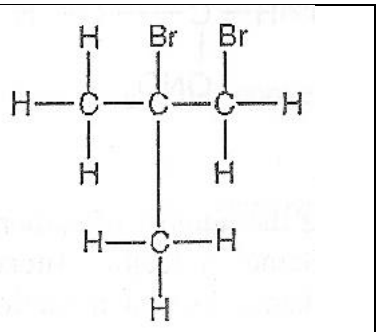
	X is more flammable than Y	X burns with a less sooty flame than Y	X is more viscous than Y
A	yes	no	no
B	yes	yes	no
C	no	yes	yes
D	no	no	yes

36 Which of the following compounds could be formed by the action of bromine on an alkene of formula C_4H_8?

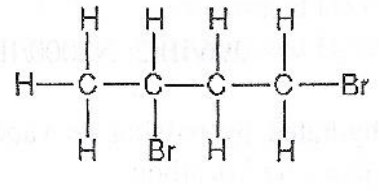
A



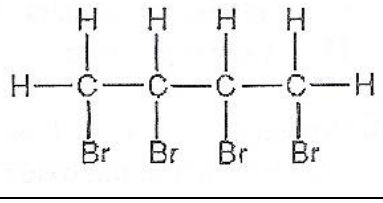
B



C



D



37 Linoleic acid is an unsaturated fatty acid with a M_r of 280. In a reaction, it was measured that 70 g of the fatty acid reacts with 254 g of iodine.

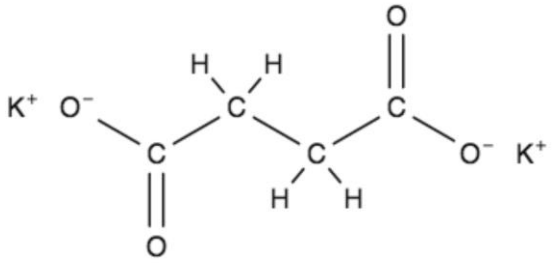
How many double bonds are there in each molecule of linoleic acid?

A 1 **B** 2

C 3 **D** 4

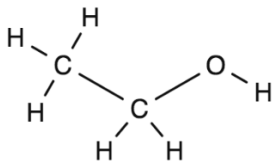
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38 An alcohol was completely oxidised to produce a carboxylic acid. This carboxylic acid was reacted with potassium hydroxide to produce a salt, which has the structural formula displayed below.

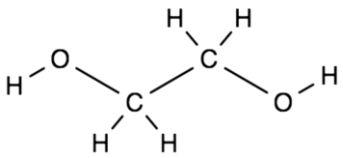


Which of the following represents the structure of the starting alcohol?

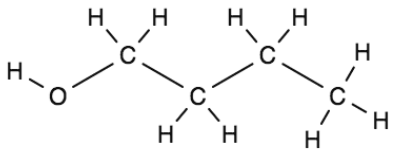
A



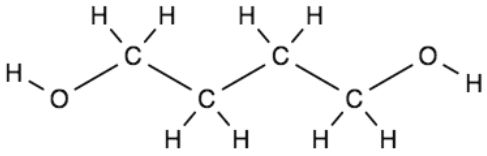
B



C



D



39 Which of the following does **not** change in the polymerisation of ethene to form poly(ethene)?

A boiling point

B density

C empirical formula

D molecular mass

40 Which of the following chemical equations does **not** represent a process that occurs in the catalytic converter of a car?

A $2C_8H_{18} + 25O_2 \rightarrow 16CO_2 + 18H_2O$

B $2CO + O_2 \rightarrow 2CO_2$

C $2N_2 + O_2 \rightarrow 2N_2O$

D $2NO + 2CO \rightarrow N_2 + 2CO_2$

End of Paper

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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 –		114 Fl flerovium –		116 Lv livermorium –		

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}

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