

Class/ Index Number /	Centre Number/ 'O' Level Index Number /	Name
---------------------------------	---	------



新加坡海星中学
MARIS STELLA HIGH SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

CHEMISTRY

Paper 1 Multiple Choice

6092/01

28 August 2024

1 hour

Additional Materials:

Optical Test Answer Sheet (OTAS) – 1 sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your class, index number, Centre number, O level index number and name in the spaces at the top of this page.

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 answer 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 in this question booklet.

A copy of the Periodic Table is printed on page **17**.

The use of an approved scientific calculator is expected, where appropriate.

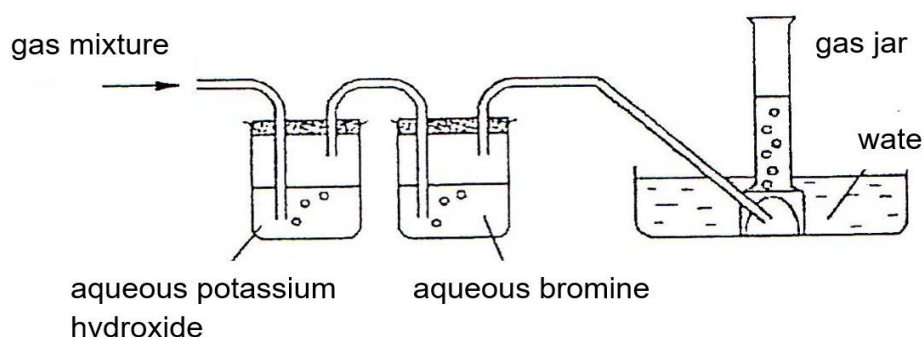
The total number of marks for this paper is 40.

At the end of the examination, hand in the following separately:

(1) Optical Test Answer Sheet (OTAS)

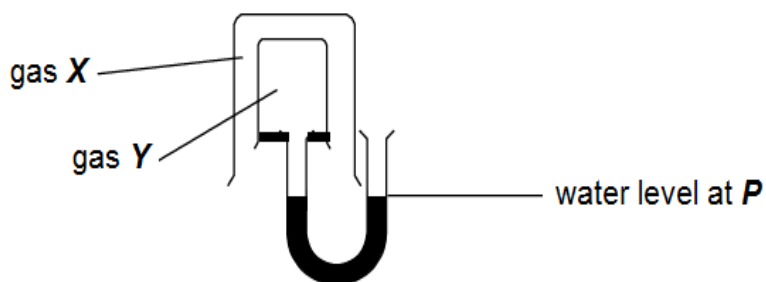
(2) Question Paper

- 1 A gaseous mixture of oxygen, sulfur dioxide and propene are passed through the apparatus shown below. Only one gas is collected.



What is the property of the gas collected?

- A turns moist blue litmus red.
 - B relights a glowing splint.
 - C burns with a yellow flame.
 - D turns acidified potassium manganate(VII) solution colourless.
- 2 An experiment was conducted to compare the diffusion of gas X and gas Y.



Which pair of gases could be X and Y that will cause a decrease in the water level at P?

	gas X	gas Y
A	carbon monoxide	fluorine
B	fluorine	neon
C	methane	oxygen
D	nitrogen	carbon dioxide

- 3 A series of experiments were conducted on a substance.
Which observation suggests that the substance cannot be an element?

- A It has a fixed melting point.
- B It forms two oxides when heated in air.
- C It produces one spot on the chromatogram.
- D It forms two products when the molten substance undergoes electrolysis.

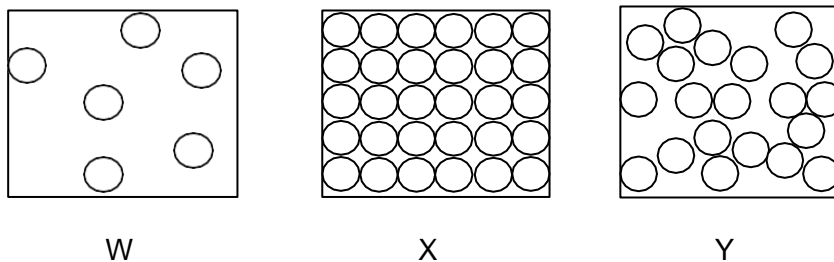
- 4 The R_f values of some substances in ethanol are shown below.

substance	R_f value
X	0.20
Y	0.80
Z	0.45

Which of the following cannot be concluded from the R_f value of X?

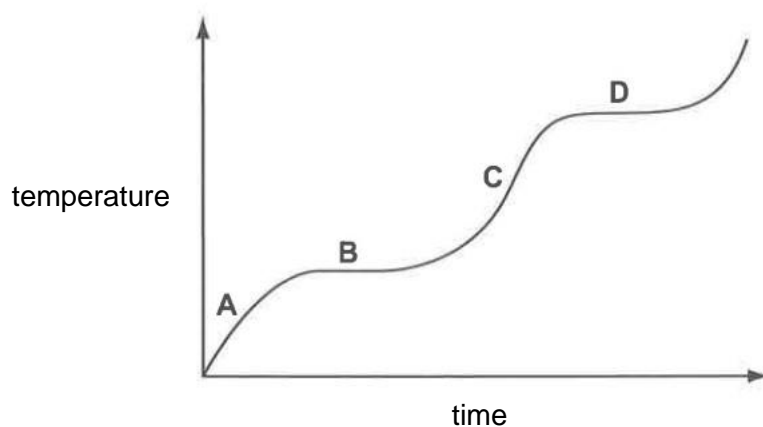
- A X is less soluble in ethanol than Y and Z.
- B X will also have the same R_f value when the solvent used is water.
- C The distance travelled by Y is four times the distance travelled by X.
- D The distance travelled by X is one-fifth the distance travelled by ethanol.

- 5 Diagrams W, X and Y show how the particles of a substance are packed at different temperatures.

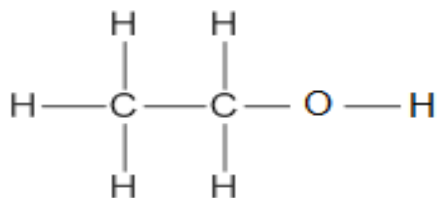


The graph below shows the temperature changes which occur upon warming the substance.

In which region of the graph would all the particles be packed as in Y?



- 6 Ethanol has the structure shown.



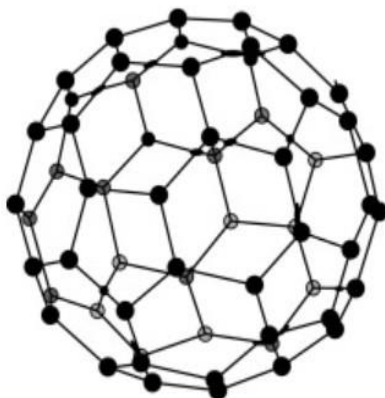
How many of the electrons in a molecule of ethanol are not involved in bonding?

- A 6
- B 8
- C 10
- D 12

- 7 An element X has an electronic configuration 2.1. The compound formed when X combines with oxygen is most likely to be
- A a liquid at room temperature.
 - B a compound with a low melting point.
 - C a good conductor of electricity in both solid and molten states.
 - D a solid that dissolves in water to form an electrolyte.
- 8 Scientists have discovered the use of an isotope of lead, Pb, which can treat non-cancerous eye disorders. ^{210}Pb is an isotope of ^{207}Pb .

Which statement about these isotopes is correct?

- A ^{210}Pb atom has 210 neutrons but ^{207}Pb atom has 207 neutrons.
 - B ^{210}Pb atom and ^{207}Pb atom have 125 protons each.
 - C ^{210}Pb atom has 3 neutrons more than ^{207}Pb atom.
 - D ^{210}Pb atom has 3 protons more than ^{207}Pb atom.
- 9 Buckminsterfullerene is a form of carbon. The diagram shows the structure of a molecule of buckminsterfullerene, which is made up of 60 carbon atoms.



Which of the following would most likely be the properties of buckminsterfullerene?

	melting point	solubility in water	electrical conductivity as a solid
A	high	insoluble	good
B	high	soluble	poor
C	low	insoluble	good
D	low	soluble	poor

- 10** Which statement best explains why calcium oxide has a higher melting point than potassium bromide?
- A** Calcium oxide is a covalent compound and potassium bromide is an ionic compound.
 - B** Calcium is less reactive than potassium.
 - C** The forces of attraction between calcium ions and oxide ions is stronger than that between potassium ions and bromide ions.
 - D** The melting point of potassium is lower than calcium.
- 11** If 2 g of hydrogen gas contains x molecules, how many molecules will 2 g of oxygen gas contain?
- A** $\frac{x}{2}$
 - B** $\frac{x}{16}$
 - C** $\frac{x}{32}$
 - D** x
- 12** Under certain conditions, 50 cm³ of a gaseous compound, N_xO_y, decomposes completely to give 50 cm³ of nitrogen gas and 25 cm³ of oxygen gas. All gas volumes are measured at the same temperature and pressure.
- Which of the following about the values x and y is correct?
- A** $x = 1, y = 2$
 - B** $x = 2, y = 1$
 - C** $x = 2, y = 3$
 - D** $x = 2, y = 4$
- 13** Zinc oxide is produced by heating zinc carbonate.



What is the percentage yield of zinc oxide if 125 g of zinc carbonate on heating produces 75 g of zinc oxide? ($M_r \text{ ZnCO}_3 = 125$, $M_r \text{ ZnO} = 81$)

- A** $125 \times \frac{81}{75} \times 100$
- B** $125 \times \frac{75}{81} \times 100$
- C** $\frac{1}{125} \times \frac{75}{81} \times 100$
- D** $\frac{75}{81} \times 100$

- 14 18 g of magnesium required $x \text{ cm}^3$ of 0.500 mol/dm^3 dilute hydrochloric acid to react completely. What is the value of x ?
- A 3000
B 1500
C 3
D 1.5
- 15 Which of the following does not show suitable reagents used for preparation of the named salts?

	salt	reagents
A	barium sulfate	barium nitrate solution + sulfuric acid
B	lithium nitrate	lithium hydroxide solution + nitric acid
C	magnesium chloride	magnesium + hydrochloric acid
D	lead(II) chloride	lead(II) carbonate + hydrochloric acid

- 16 Salt PQ is to be prepared by reacting the carbonate of P with the acid HQ by titration.

What are the solubilities of the carbonate, the acid and the salt in water?

	carbonate of P	acid HQ	salt PQ
A	insoluble	soluble	insoluble
B	soluble	soluble	soluble
C	soluble	insoluble	insoluble
D	insoluble	soluble	soluble

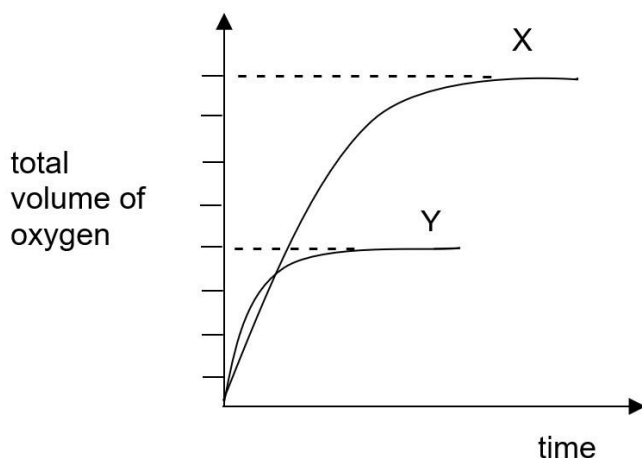
- 17 When a solution of zinc sulfate was added to a solution containing the nitrates of barium, iron and copper, a white precipitate forms. What is the precipitate?
- A zinc nitrate
B iron(II) sulfate
C copper(II) sulfate
D barium sulfate

- 18** An excess of sodium hydroxide is added to an aqueous solution of salt **X** and boiled. No observable change seen. However, ammonia gas is only given off after aluminium foil is added to the hot solution.

What could X be?

- A** ammonium chloride **B** sodium chloride
C ammonium sulfate **D** sodium nitrate

- 19** Graphs X and Y shown below represent the results of two experiments (X and Y), demonstrating the catalytic decomposition of hydrogen peroxide using manganese(IV) oxide.



Assuming that all other conditions are kept constant, which of the following is a correct explanation of the results?

	experiment X	experiment Y
A	20 cm ³ of 1.0 mol/dm ³ hydrogen peroxide was used.	5 cm ³ of 2.0 mol/dm ³ hydrogen peroxide was used.
B	20 cm ³ of 1.0 mol/dm ³ hydrogen peroxide was used.	10 cm ³ of 2.0 mol/dm ³ hydrogen peroxide was used.
C	1.0 g of manganese(IV) oxide was used.	0.5 g of manganese(IV) oxide was used.
D	reaction was carried out at 60 °C.	reaction was carried out at 30 °C.

- 20** Rubidium, Rb, is an element in the same group of the Periodic Table as lithium, sodium and potassium.

Which statement/s about rubidium is/are likely to be incorrect?

- 1 It forms a soluble carbonate salt.
- 2 It reacts explosively with cold water.
- 3 It forms a carbonate with a chemical formula of RbCO_3 .
- 4 It can be extracted via electrolysis of concentrated aqueous RbCl .

A 1 and 2

B 1 and 3

C 2 and 3

D 3 and 4

- 21** W, X, Y and Z are four consecutive elements in the Periodic Table. W is a halogen. Which of the following chemical formulae of the compound formed from the elements is correct?

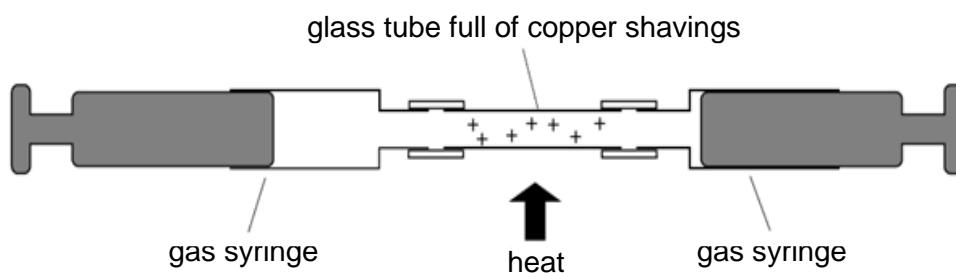
A Z_2W

B Y_2W

C ZW_2

D YW_2

- 22** A 150 cm^3 sample of air was passed into the apparatus shown below:



The gas was passed between the two gas syringes and over the heated copper turnings. What is the final volume of gas left in the apparatus?

A 31 cm^3

B 79 cm^3

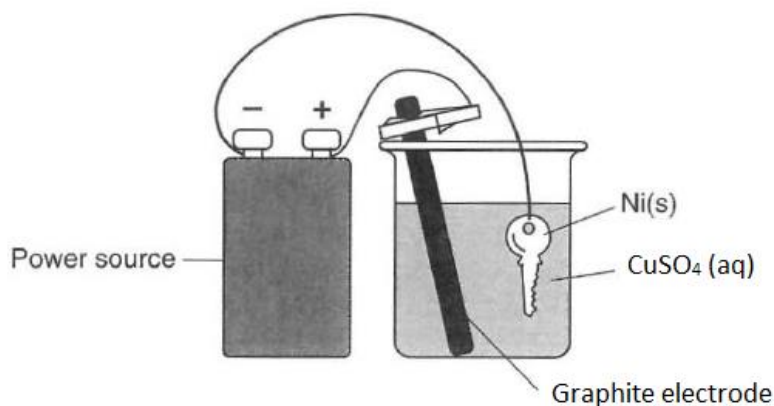
C 119 cm^3

D 173 cm^3



- D** **W** **Cu** **V** **U**

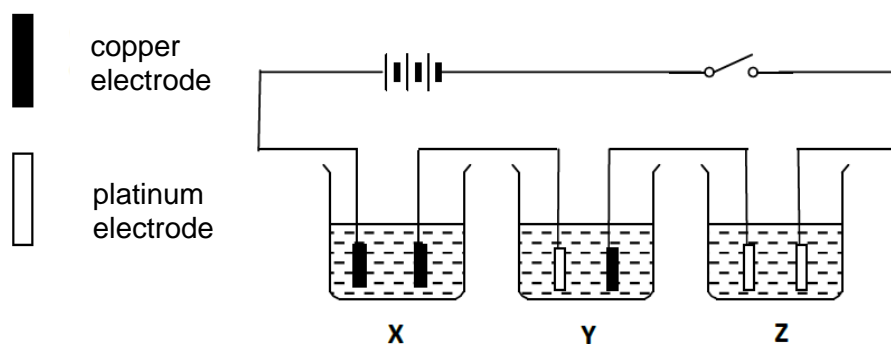
- 26 A student wants to electroplate his key. He sets up his electrolytic cell as shown below.



Which of the following observations will he make after some time?

	graphite electrode	key	solution
A	effervescence is observed	pink-brown deposit	remains blue
B	no visible change	grey deposit	remains blue
C	effervescence is observed	pink-brown deposit	blue solution fades
D	no visible change	pink-brown deposit	blue solution fades

- 27 The electrolyte in the three cells below is 2 mol/dm³ copper(II) sulfate solution. The switch is closed and the colour of the electrolyte is observed as electrolysis progresses.

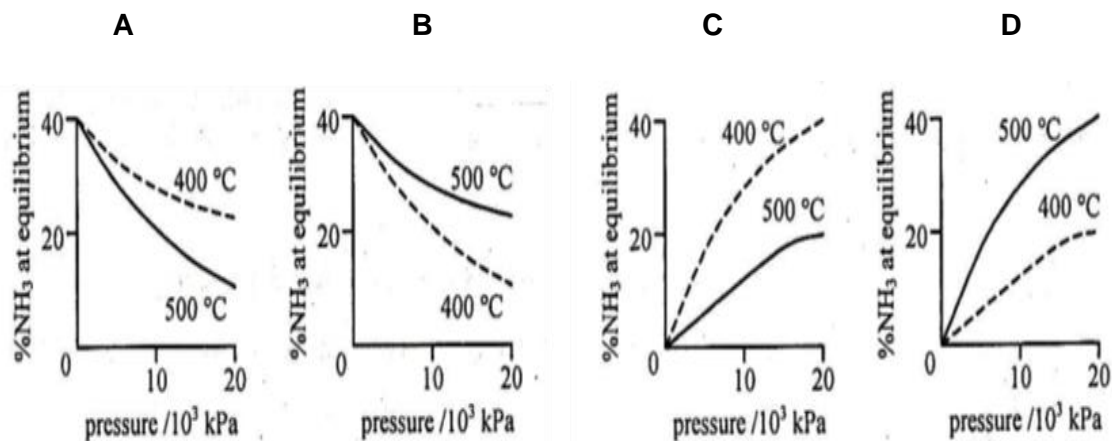


In which of the cells will the blue colour of the electrolyte fade?

- A** Z only **B** X and Z
C X and Y **D** Y and Z

- 28** The percentage of ammonia obtained at equilibrium in the Haber Process is plotted against pressure for two temperatures, 400°C and 500°C.

Which of the following correctly represents the two graphs obtained?



- 29** Copper(II) carbonate, zinc carbonate and calcium carbonate decompose on heating to produce metal oxides and carbon dioxide gas.

Which of the following shows the correct order of temperature at which their decomposition occurs?

lowest temperature → highest temperature		
A calcium carbonate	copper(II) carbonate	zinc carbonate
B copper(II) carbonate	zinc carbonate	calcium carbonate
C zinc carbonate	calcium carbonate	copper(II) carbonate
D zinc carbonate	copper(II) carbonate	calcium carbonate

- 30** Small pieces of different metals were added to aqueous solutions. Use the information below to answer **Question 30 and 31**.

solution	metal added				
	X	iron	copper	zinc	Y
copper(II) chloride	copper displaced	copper displaced		copper displaced	copper displaced
nitrate of metal X		metal X displaced	no reaction	metal X displaced	metal X displaced
iron(III) chloride	no reaction		no reaction	iron displaced	iron displaced
chloride of metal Y	no reaction	no reaction	no reaction	no reaction	
zinc chloride	no reaction	no reaction	no reaction		zinc displaced

Which of the following correctly shows the different metals arranged in the order of increasing reactivity?

- A** copper, iron, X, zinc, Y
- B** copper, X, iron, zinc, Y
- C** X, copper, iron, zinc, Y
- D** X, iron, copper, Y, zinc

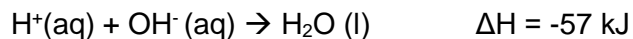
- 31** Which is the preferred method to extract metal **Y** from its ore?

- A** heating the ore with ammonia
- B** heating the ore
- C** electrolysis of its molten ore
- D** heating the ore with carbon

- 32** Which of the following gases cannot be removed from the exhaust gases of a petrol-powered car by its catalytic converter?

- A** carbon dioxide
- B** carbon monoxide
- C** hydrocarbons
- D** nitrogen dioxide

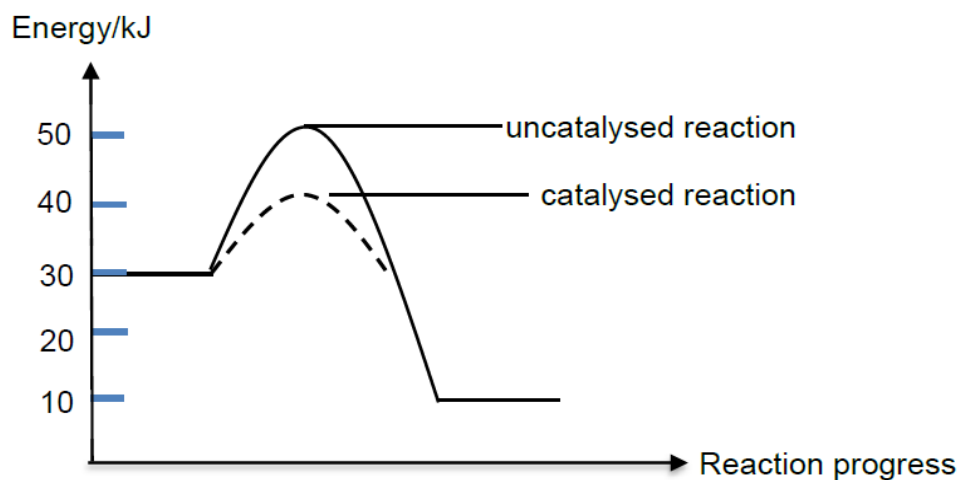
- 33** The enthalpy change when one mole of hydrogen ions is neutralised is known as the enthalpy of neutralisation.



How much energy is released when one mole of sulfuric acid is completely neutralised?

- A** 228 kJ **B** 57 kJ
C 114 kJ **D** 28.5 kJ

- 34** The energy diagram for a particular reaction under catalysed and uncatalysed conditions is shown below.



What is the activation energy of the **backward catalysed** reaction?

- A** +40 kJ **B** +20 kJ
C +30 kJ **D** +10 kJ

- 35** Useful fractions are obtained by the fractional distillation of petroleum. Which fraction is correctly matched with its use?

	fraction	use
A	petrol	aircraft fuel
B	bitumen	car fuel
C	kerosene	for making roads
D	petroleum gas	fuel for cooking

- 36** Amines are organic compounds with the functional group -NH_2 .
The first four members of the amine homologous series is shown below.

name	chemical formula
methylamine	CH_3NH_2
ethylamine	$\text{CH}_3\text{CH}_2\text{NH}_2$
propylamine	$\text{CH}_3\text{CH}_2\text{CH}_2\text{NH}_2$
butylamine	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{NH}_2$

What is the general formula for amines?

- A** $\text{C}_n\text{H}_{2n+3}\text{N}$
B $\text{C}_n\text{H}_{2n-1}\text{NH}_2$
C $\text{C}_n\text{H}_{2n+1}\text{NH}_2$
D $\text{C}_n\text{H}_{2n+1}\text{CHNH}_2$
- 37** An alkene has one functional group per molecule. 2.8 g of the alkene reacts with 8.0 g of bromine. What is the chemical formula of the alkene?

- A** C_2H_4
B C_3H_6
C C_4H_8
D C_5H_{10}

- 38** Organic compound X underwent the following successive reactions:

- 1 reaction with steam at 300°C , 60 atm and phosphoric(V) acid
- 2 reaction with excess acidified potassium manganate(VII)

The final organic product was $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOH}$.

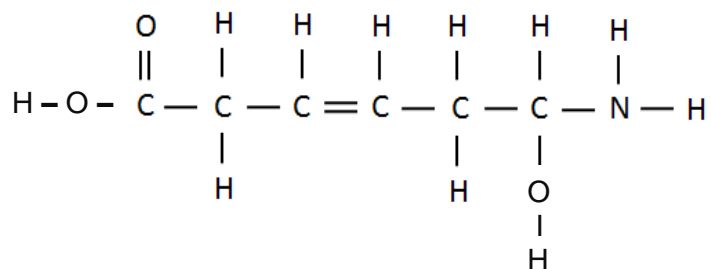
Which of the following is likely to be X?

- A** $\text{CH}_3\text{CH}=\text{CH}_2$
B $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
C $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
D $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_3$

39 What is the formula of the ester formed when propanoic acid reacts with ethanol?

- A** $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_2\text{CH}_3$
- B** $\text{CH}_3\text{CH}_2\text{CO}_2\text{CH}_3$
- C** $\text{CH}_3\text{CO}_2\text{CH}_2\text{CH}_3$
- D** $\text{CH}_3\text{CO}_2\text{CH}_3$

40 The diagram below shows an organic molecule.



How many different types of polymer can be formed using the monomer above?

- A** none
- B** one
- C** two
- D** three

End of Paper

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
<div> <div>Key</div> <div>proton (atomic) number</div> <div>atomic symbol</div> <div>name</div> <div>relative atomic mass</div> </div>							1 H hydrogen 1										
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	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 oganeson —

17

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 dm³ at room temperature and pressure (r.t.p.).
The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$

