

Name	Class	Index Number



Anglo-Chinese School (Barker Road)

PRELIMINARY EXAMINATION 2024 SECONDARY FOUR EXPRESS

CHEMISTRY
6092/1

TIME: 1 HOUR

INSTRUCTIONS TO CANDIDATES:

Do not open this booklet until you are told to do so.

Read the instructions on the OTAS answer sheet carefully.

Write your index number, subject code and paper number clearly on the OTAS answer sheet provided for you.

There are **forty** multiple choice 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 OTAS answer sheet.

INFORMATION FOR CANDIDATES

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.

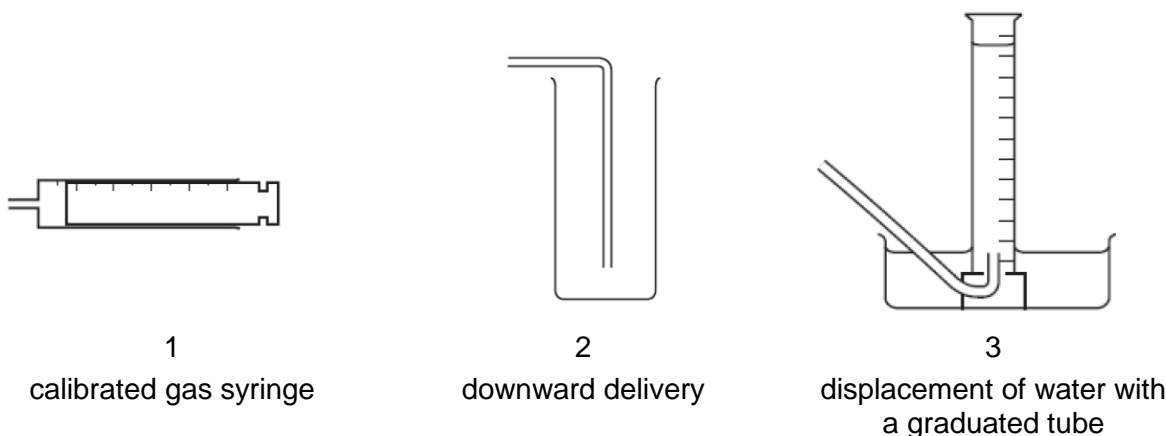
The use of an approved scientific calculator is expected, where appropriate.

A copy of the Periodic Table is printed on the last page.

This paper consists of 19 printed pages including the cover page.

- 1 An experiment is carried out to investigate the rate of reaction when calcium carbonate reacts with hydrochloric acid. The volume of carbon dioxide gas given off is measured at different intervals of time.

The diagram shows pieces of apparatus used to collect gases.



Which apparatus is suitable to collect and measure the volume of carbon dioxide?

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

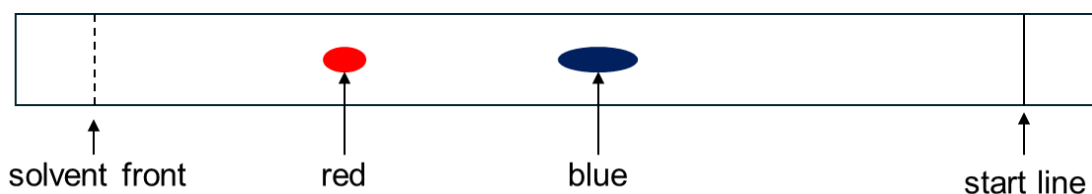
- 2 The table below shows some properties of ethanol and hexane.

	ethanol	hexane
M_r	18	86
boiling point / °C	78.4	68.7
density / g/cm ³	0.789	0.655
miscibility in water	miscible	immiscible

How can a mixture of ethanol and water and a mixture of hexane and water be separated?

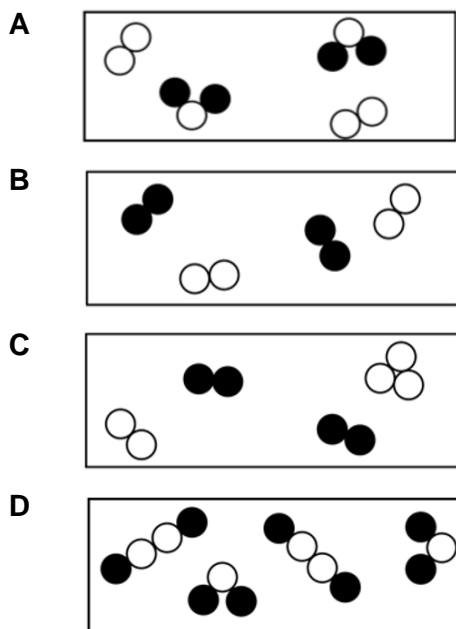
	ethanol and water mixture	hexane and water mixture
A	fractional distillation	chromatography
B	fractional distillation	fractional distillation
C	fractional distillation	separating funnel
D	separating funnel	fractional distillation

- 3 The chromatogram of a sugar syrup is shown below:



Which of the following statements can be inferred from the chromatogram?

- A** The experiment is unfair because the chromatogram is not conducted vertically.
- B** The molecules of the blue dye diffused faster than those of the red dye.
- C** The red dye is more soluble in the solvent than the blue dye.
- D** The R_f value of the blue dye is greater than that of the red dye.
- 4 Which diagram shows the arrangement of particles in a mixture of an element and a compound?



- 5 Which statement correctly explains why bromine gas at 50 °C diffuses more slowly than krypton at 20 °C?
- A** Bromine gas has a higher relative mass than krypton.
- B** Bromine gas is at a higher temperature than krypton.
- C** Bromine gas is diatomic and krypton is monoatomic.
- D** Bromine gas is more reactive than krypton.

- 6 The table shows information about particles X and Y.

	number of protons	number of neutrons	electronic configuration
X	9	10	2, 8
Y	17	20	2, 8, 8

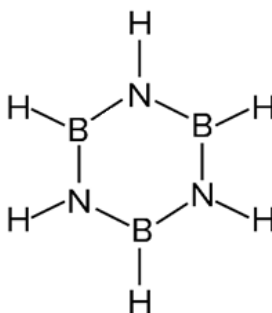
Which statement is correct for both X and Y?

- A They are atoms of metallic elements.
 B They are atoms of noble gases.
 C They are isotopes of the same element.
 D They are negative ions.
- 7 Magnalium is an alloy of aluminium (85 %) and magnesium (15 %).

Some properties of magnalium are listed below.

Which property of magnalium is the main reason for its use in the construction of aircrafts?

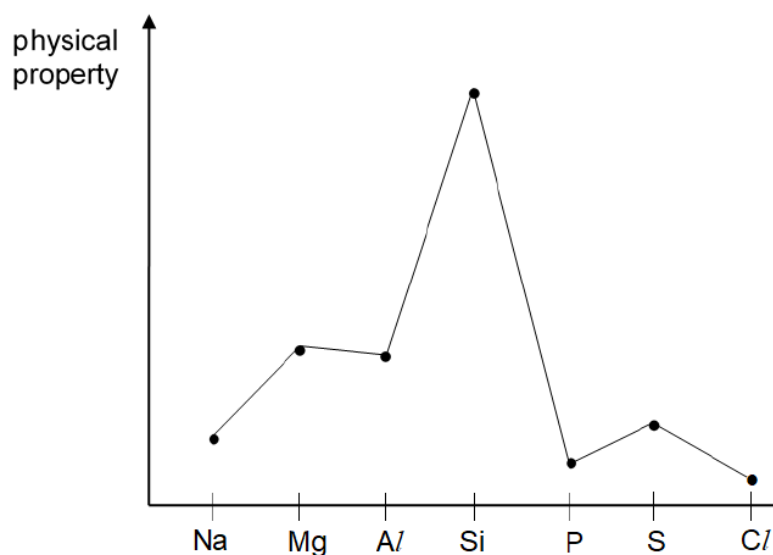
- A It conducts electricity.
 B It is denser than aluminium.
 C It is stronger than aluminium or magnesium.
 D The surface of the alloy is covered by a layer of magnesium oxide.
- 8 Borazine is a compound with the chemical formula $B_3H_6N_3$, and the full structural formula is given as follows:



Which statement about borazine is **not** true?

- A Borazine is a crystalline solid with a high melting point.
 B Boron shows the same valency as nitrogen in the compound.
 C The percentage composition of nitrogen is 51.9 %.
 D The relative molecular mass of borazine is 81.

- 9 Which two substances have similar three-dimensional arrangements of their atoms?
- A diamond and silicon dioxide
 - B graphite and diamond
 - C iodine and graphite
 - D silicon dioxide and iodine
- 10 The graph below shows the variation of a physical property of elements in Period 3 in the Periodic Table.



What is the physical property that varies?

- A atomic radius
- B electrical conductivity
- C melting point
- D valency

- 11 Elements X and Y are in Group 1 of the Periodic Table.

When X and Y are added to separate beakers of cold water, X is first observed to sink to the bottom of the beaker, while Y floats on water.

Which statements about X and Y are correct?

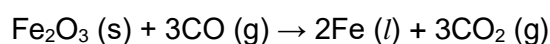
- 1 Atoms of Y have more protons than atoms of X.
- 2 Effervescence is observed immediately when Y is added to cold water.
- 3 X has a lower boiling point than Y.

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

- 12 Which compound contains the highest percentage of sulfur by mass?

- A H_2SO_3
B K_2S
C PbS_2
D SO_2

- 13 In the industrial extraction of iron, haematite, an iron ore mainly consisting of iron(III) oxide, is heated in the presence of carbon monoxide as shown below:



A 10.00 kg sample of haematite reacts with excess carbon monoxide to produce 4.70 kg of iron.

What is the percentage purity of the iron(III) oxide in haematite?

- A 44.8 %
B 47.0 %
C 57.8 %
D 67.1 %

- 14 Analysis of molecule X shows that it contains, by mass, 59 % carbon, 10 % hydrogen and 31 % oxygen.

Which other information is needed to determine the molecular formula?

- A atomic numbers of carbon, hydrogen and oxygen only
 - B atomic numbers of carbon, hydrogen and oxygen and relative molecular mass of X
 - C relative atomic masses of carbon, hydrogen and oxygen only
 - D relative atomic masses of carbon, hydrogen and oxygen and relative molecular mass of X
- 15 To reduce atmospheric pollution, the waste gases from a coal-burning power station are passed through powdered calcium carbonate.

Which waste gas will **not** be removed by the powdered calcium carbonate?

- A carbon monoxide
 - B nitrogen dioxide
 - C phosphorus(V) oxide
 - D sulfur dioxide
- 16 Which two statements confirm the acidic nature of H_2SO_4 (aq)?
- 1 Addition of Universal Indicator to the solution shows that it has a pH value of less than 7.0.
 - 2 A white precipitate is formed when aqueous barium nitrate is added to the solution.
 - 3 The solution reacts with copper(II) oxide to form a blue solution.
 - 4 The solution turns anhydrous cobalt(II) chloride from blue to pink.
- A 1 and 2
 - B 1 and 3
 - C 2 and 4
 - D 3 and 4

- 17 Which statement best explains why farmers should not add slaked lime and ammonium nitrate fertiliser to the soil at the same time?

- A It is not economically viable to add two substances to the soil at the same time.
- B The slaked lime will react with the ammonium nitrate to make the soil too alkaline for plant growth.
- C The slaked lime will react with the ammonium nitrate to produce acid which inhibits plant growth.
- D The slaked lime will react with the ammonium nitrate to result in a loss of nitrogen.

- 18 The reaction in which the same element is both oxidised and reduced is called a *disproportionation* reaction.

Which equation is **not** an example of *disproportionation* reaction?

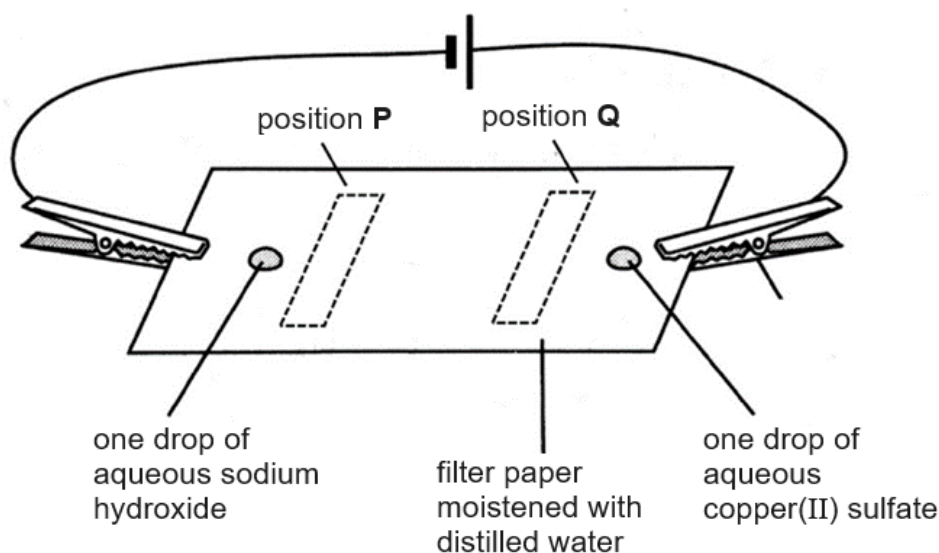
- A $3\text{BrF} \rightarrow \text{BrF}_3 + \text{Br}_2$
 B $\text{Cl}_2 + 2\text{NaOH} \rightarrow \text{NaCl} + \text{NaOCl} + \text{H}_2\text{O}$
 C $3\text{Na}_2\text{S}_2\text{O}_4 + 6\text{NaOH} \rightarrow 5\text{Na}_2\text{SO}_3 + \text{Na}_2\text{S} + 3\text{H}_2\text{O}$
 D $2\text{Pb}(\text{NO}_3)_2 \rightarrow 2\text{PbO} + 4\text{NO}_2 + \text{O}_2$

- 19 Aqueous hydrogen peroxide may behave as an oxidising or reducing agent.

In which option does hydrogen peroxide behave as an oxidising agent?

- A It decolourises acidified potassium manganate(VII).
 B It decolourises aqueous bromine.
 C It turns aqueous iron(III) nitrate pale green.
 D It turns aqueous potassium iodide brown.

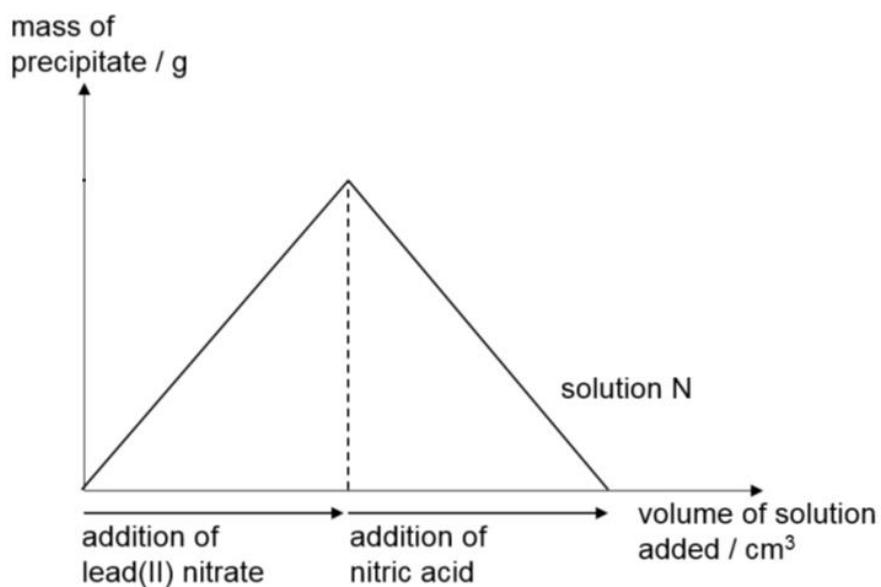
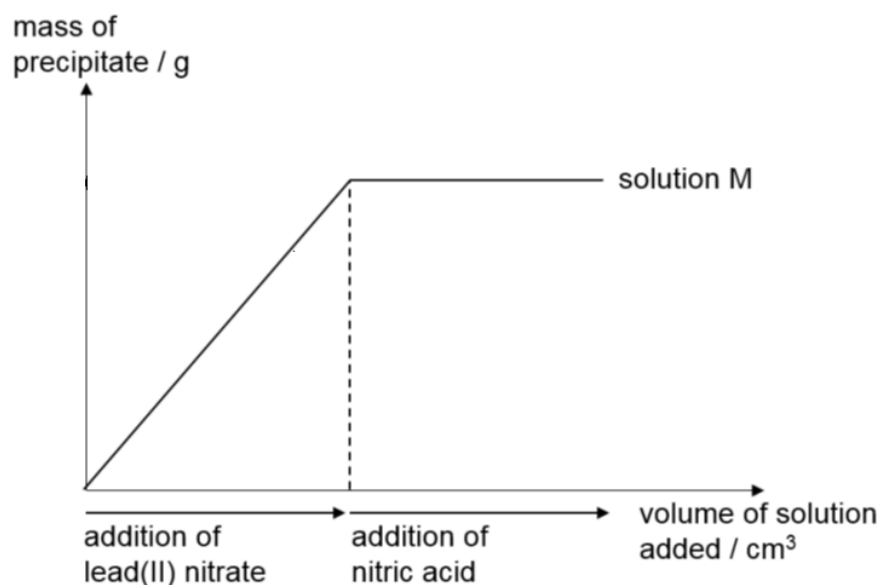
- 20 A circuit was set up as shown in the diagram below. After some time, some colouration was observed on the filter paper.



Which of the following represents the colour and position of the colouration that was observed on the filter paper?

	colour	position
A	blue	P
B	blue	Q
C	green	P
D	green	Q

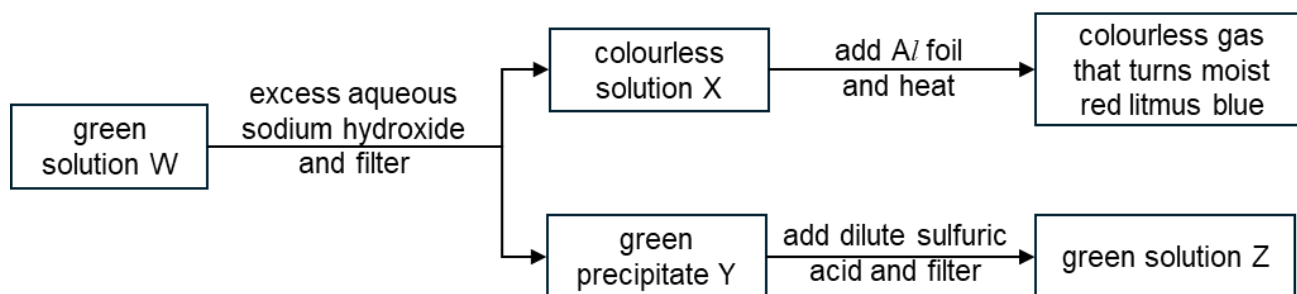
- 21 The graphs below show the mass of precipitate formed when lead(II) nitrate and nitric acid are added successively to solution M and to solution N separately.



What are the possible identities of the precipitates formed from solution M and solution N?

	precipitate in solution M	precipitate in solution N
A	PbCl_2	Pb(OH)_2
B	PbCO_3	PbSO_4
C	Pb(OH)_2	PbCO_3
D	PbSO_4	PbCl_2

22 The flowchart below shows some reactions that green solution W undergoes:



What are the identities of W, X, Y and Z?

	W	X	Y	Z
A	$\text{Cu}(\text{NO}_3)_2$	NaNO_3	$\text{Cu}(\text{OH})_2$	CuSO_4
B	CuSO_4	Na_2SO_4	$\text{Cu}(\text{OH})_2$	CuSO_4
C	$\text{Fe}(\text{NO}_3)_2$	NaNO_3	$\text{Fe}(\text{OH})_2$	FeSO_4
D	$(\text{NH}_4)_2\text{SO}_4$	NH_4OH	$\text{Fe}(\text{OH})_2$	FeSO_4

23 A student wishes to prepare a sample of zinc chloride. He carried out the experiment in the following steps:

- Step 1: Cool to obtain crystals and dry the crystals between sheets of filter paper.
- Step 2: Add excess zinc to the solution.
- Step 3: Heat the filtrate over an evaporating dish.
- Step 4: Place some dilute hydrochloric acid into a 250 cm^3 glass beaker.
- Step 5: Filter out the excess solid.

In which order should the above steps be carried out?

- A** 2, 5, 4, 1, 3
- B** 4, 2, 3, 5, 1
- C** 4, 2, 5, 3, 1
- D** 4, 3, 2, 1, 5

- 24** The carbonates of three metals, X, Y and Z, are heated and the results are shown below.

metal carbonate	effect of heat
X	gas evolved forms a white precipitate with limewater and solid does not change colour
Y	gas evolved forms a white precipitate with limewater and solid changes colour from green to black
Z	no observable change

Three statements were made based on the results:

- 1 Metal X is more reactive than metal Z.
- 2 Metal Y is a transition metal.
- 3 Metal Z can be extracted from its molten ore via electrolysis.

Which statements are true?

- A** 3 only
B 1 and 2
C 2 and 3
D 1, 2 and 3
- 25** Three simple cells are set up using copper, aluminium and two other unknown metals, W and X as electrodes, immersed in dilute sulfuric acid of the same concentration. The potential differences between the metals are given in the table below.

cell	metals used	voltage / V	negative electrode
1	Cu, Al	+2.02	Al
2	Cu, W	+0.45	Cu
3	Cu, X	+1.11	X

From these results, deduce the order of the metals W, X, Al and Cu in increasing ease of oxidation.

- A** X, Cu, W, Al
B Al, Cu, W, X
C W, Cu, X, Al
D W, Cu, Al, X

26 Four electrolytes are listed. Each is electrolysed using inert electrodes.

- 1 aqueous copper(II) iodide
- 2 concentrated aqueous sodium chloride
- 3 dilute aqueous sodium chloride
- 4 molten aluminium oxide

For which electrolytes is a metal formed at the cathode (negative electrode)?

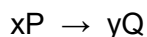
- A** 1 and 2
B 1 and 4
C 2 and 3
D 3 and 4

27 In two separate electroplating experiments, the same amount of charge deposited 54.0 g of silver and 14.9 g of tin.

What was the most likely charge of the tin ion?

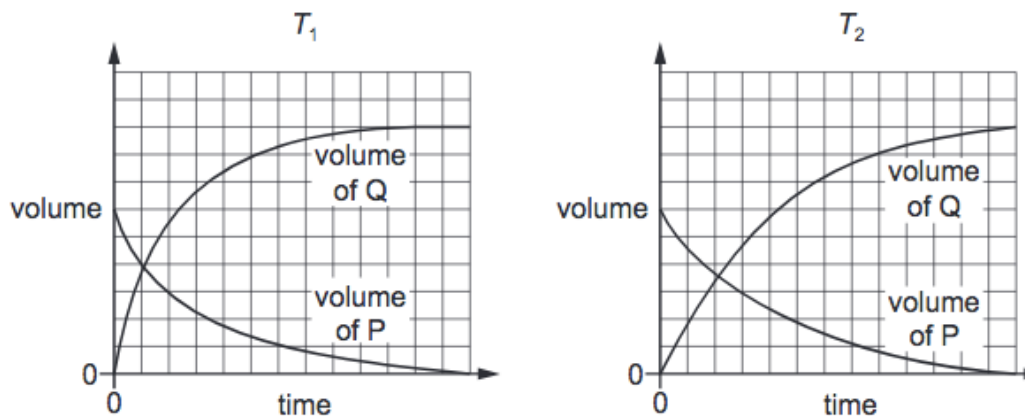
- A** +1
B +2
C +3
D +4

28 Gas P decays to form gas Q.



Two experiments are carried out to investigate the rate of reaction. The conditions are the same except that two different temperatures, T_1 and T_2 , are used.

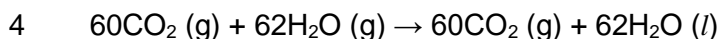
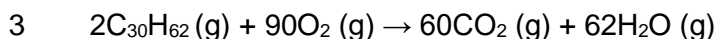
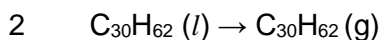
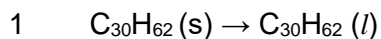
The results are plotted on graphs, drawn to the same scale.



Which row is correct?

	x	y	temperature
A	2	3	T_1 is higher than T_2
B	2	3	T_2 is higher than T_1
C	3	2	T_1 is higher than T_2
D	3	2	T_2 is higher than T_1

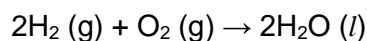
29 The equations below show four stages, 1 to 4, in the conversion of solid candlewax, $C_{30}H_{62}$, into carbon dioxide and water.



Which stages are exothermic?

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

30 Hydrogen burns in air to form water as shown:



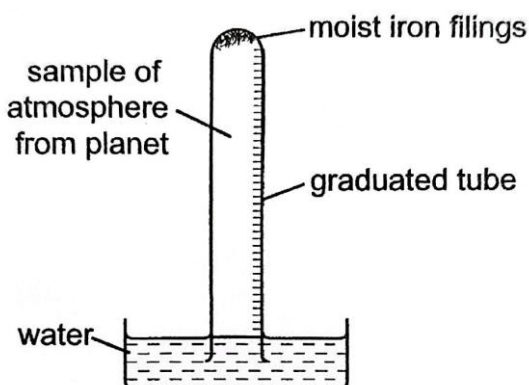
Which statement concerning the enthalpy change, ΔH , for the reaction is correct?

	ΔH	explanation
A	negative	energy change in breaking bonds in hydrogen and oxygen is greater than the energy change in making bonds in water
B	negative	energy change in breaking bonds in hydrogen and oxygen is less than the energy change in making bonds in water
C	positive	energy change in breaking bonds in hydrogen and oxygen is greater than the energy change in making bonds in water
D	positive	energy change in breaking bonds in hydrogen and oxygen is less than the energy change in making bonds in water

31 The atmosphere of a newly discovered planet contains the following gases:

carbon dioxide	20 %
nitrogen	40 %
noble gases	10 %
oxygen	30 %

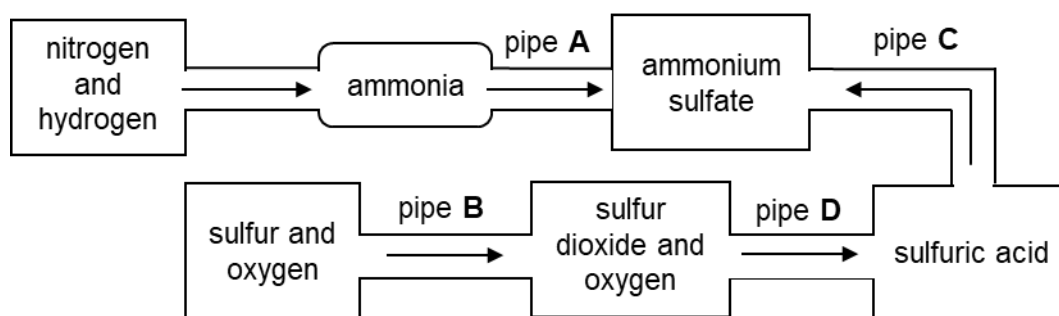
The apparatus below was set up with a 100 cm^3 sample of the atmosphere of the planet in the graduated tube. The volume of the sample was measured at intervals until no further change in volume took place.



What volume of the sample would remain?

- A** 30 cm^3
- B** 40 cm^3
- C** 70 cm^3
- D** 80 cm^3

32 The diagram shows some of the stages in the manufacture of ammonium sulfate.



From which of the connecting pipes would a major leak result in the highest **decrease** in the pH of the rain?

33 Petrol and diesel are two common fuels used by cars and buses respectively. The combustion of these fuels produces air pollutants. The table below shows the mass of pollutants found in exhaust fumes when 1 kg of each fuel is burnt.

pollutant produced	mass of pollutant after petrol is burnt / g	mass of pollutant after diesel is burnt / g
carbon monoxide	240	10
oxides of nitrogen	30	60
sulfur dioxide	1	4
unburnt hydrocarbons	25	20

Which of the following statements can be inferred from the table?

- A Burning of petrol contributes more towards the formation of acid rain than burning of diesel.
- B Petrol-powered engines take in more air than diesel-powered engines.
- C The percentage by mass of sulfur-containing compounds is lower in diesel.
- D The temperature in petrol-powered engines is lower than that in diesel-powered engines.

34 Petroleum can be separated into fractions by fractional distillation.

Which statement about this process is correct?

- A In a fractionating column, the bitumen fraction is obtained above the kerosene fraction.
- B The fraction obtained at the top of the fractionating column has the highest boiling point.
- C The lubricating oil fraction is a source for making polishes and waxes.
- D The relative molecular masses of the compounds obtained near the bottom of the fractionating column are smaller than those of the compounds obtained near the top of the column.

- 35 Which of the following shows the correct equation and condition of the reaction between chlorine and methane?

	equation	condition
A	$\text{Cl}_2 + \text{CH}_4 \rightarrow \text{CH}_2\text{Cl}_2 + \text{H}_2$	gases are mixed in the presence of UV light
B	$\text{Cl}_2 + \text{CH}_4 \rightarrow \text{CH}_2\text{Cl}_2 + \text{H}_2$	methane is bubbled into aqueous chlorine
C	$\text{Cl}_2 + \text{CH}_4 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$	gases are mixed in the presence of UV light
D	$\text{Cl}_2 + \text{CH}_4 \rightarrow \text{CH}_3\text{Cl} + \text{HCl}$	methane is bubbled into aqueous chlorine

- 36 0.025 mol of vegetable oil was found to increase its mass by 25.4 g when shaken with an excess of iodine solution.

How many C=C bonds are there in one molecule of the oil?

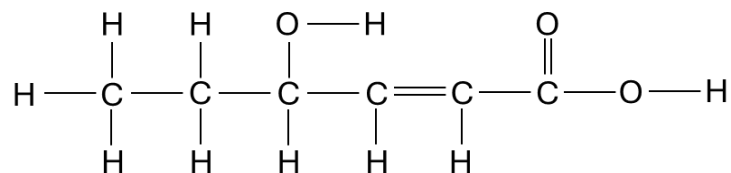
- A** 1
B 2
C 3
D 4

- 37 Ethanol can be manufactured from ethene or from glucose. The table gives statements about the processes involved.

In which row are both statements correct?

	process using ethene	process using glucose
A	ethene is obtained by cracking	oxygen is also produced in the reaction
B	phosphoric(V) acid is used as a catalyst	the rate of the reaction is slow
C	uses temperatures around 300 °C	uses temperatures around 100 °C
D	the reaction is carried out in aqueous solutions	the reaction is carried out with the reagents as gases

38 The full structural formula of 4-hydroxy-2-hexanoic acid is shown below:



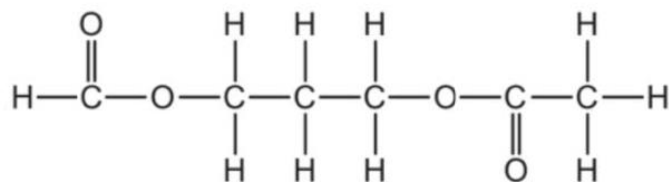
Which of the following is **incorrect** about 4-hydroxy-2-hexanoic acid?

- A A diol is formed when it is reacted with steam in the presence of phosphoric(V) acid.
- B A pungent gas is evolved when sodium is added to its aqueous solution.
- C It can form both addition and condensation polymers.
- D It is not a hydrocarbon.

39 In which reaction does the product have more carbon atoms than the underlined reactant?

	reactants	product
A	amine and <u>carboxylic acid</u>	amide
B	oxygen gas and <u>pentane</u>	carbon dioxide
C	<u>alcohol</u> and oxidising agent	carboxylic acid
D	<u>carboxylic acid</u> and sodium carbonate	salt

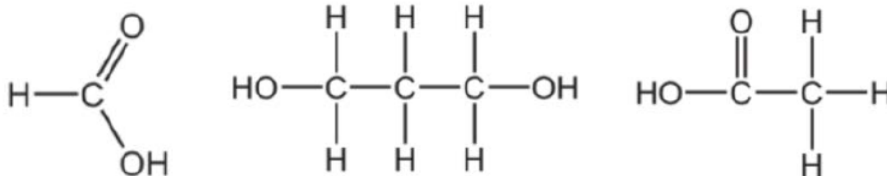
- 40 The diester below can first be hydrolysed to obtain its monomers by heating with dilute acid.



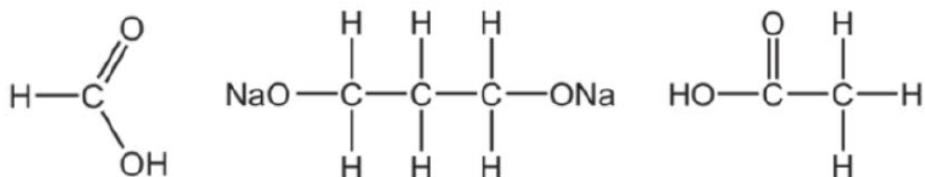
Aqueous sodium hydroxide is then added to the monomers formed.

What would be the products of the reaction?

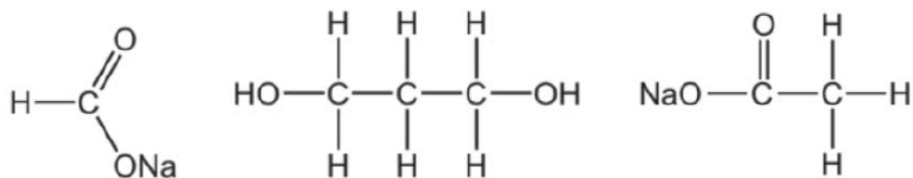
A



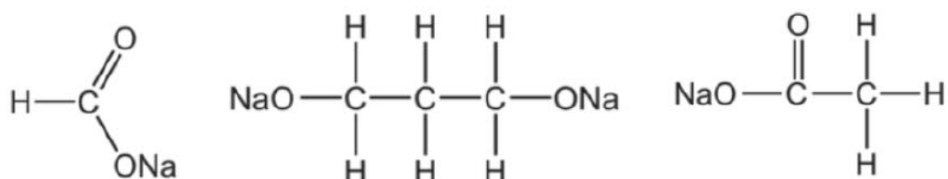
B



C



D



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>							<div>1</div> <div>H</div> <div>hydrogen</div> <div>1</div>										<div>2</div> <div>He</div> <div>helium</div> <div>4</div>
												<div>5</div> <div>B</div> <div>boron</div> <div>11</div>	<div>6</div> <div>C</div> <div>carbon</div> <div>12</div>	<div>7</div> <div>N</div> <div>nitrogen</div> <div>14</div>	<div>8</div> <div>O</div> <div>oxygen</div> <div>16</div>	<div>9</div> <div>F</div> <div>fluorine</div> <div>19</div>	<div>10</div> <div>Ne</div> <div>neon</div> <div>20</div>
												<div>13</div> <div>Al</div> <div>aluminium</div> <div>27</div>	<div>14</div> <div>Si</div> <div>silicon</div> <div>28</div>	<div>15</div> <div>P</div> <div>phosphorus</div> <div>31</div>	<div>16</div> <div>S</div> <div>sulfur</div> <div>32</div>	<div>17</div> <div>Cl</div> <div>chlorine</div> <div>35.5</div>	<div>18</div> <div>Ar</div> <div>argon</div> <div>40</div>
<div>11</div> <div>Na</div> <div>sodium</div> <div>23</div>	<div>12</div> <div>Mg</div> <div>magnesium</div> <div>24</div>	3	4	5	6	7	8	9	10	11	12	31	32	33	34	35	36
<div>19</div> <div>K</div> <div>potassium</div> <div>39</div>	<div>20</div> <div>Ca</div> <div>calcium</div> <div>40</div>	<div>21</div> <div>Sc</div> <div>scandium</div> <div>45</div>	<div>22</div> <div>Ti</div> <div>titanium</div> <div>48</div>	<div>23</div> <div>V</div> <div>vanadium</div> <div>51</div>	<div>24</div> <div>Cr</div> <div>chromium</div> <div>52</div>	<div>25</div> <div>Mn</div> <div>manganese</div> <div>55</div>	<div>26</div> <div>Fe</div> <div>iron</div> <div>56</div>	<div>27</div> <div>Co</div> <div>cobalt</div> <div>59</div>	<div>28</div> <div>Ni</div> <div>nickel</div> <div>59</div>	<div>29</div> <div>Cu</div> <div>copper</div> <div>64</div>	<div>30</div> <div>Zn</div> <div>zinc</div> <div>65</div>	<div>31</div> <div>Ga</div> <div>gallium</div> <div>70</div>	<div>32</div> <div>Ge</div> <div>germanium</div> <div>73</div>	<div>33</div> <div>As</div> <div>arsenic</div> <div>75</div>	<div>34</div> <div>Se</div> <div>selenium</div> <div>79</div>	<div>35</div> <div>Br</div> <div>bromine</div> <div>80</div>	<div>36</div> <div>Kr</div> <div>krypton</div> <div>84</div>
<div>37</div> <div>Rb</div> <div>rubidium</div> <div>85</div>	<div>38</div> <div>Sr</div> <div>strontium</div> <div>88</div>	<div>39</div> <div>Y</div> <div>yttrium</div> <div>89</div>	<div>40</div> <div>Zr</div> <div>zirconium</div> <div>91</div>	<div>41</div> <div>Nb</div> <div>niobium</div> <div>93</div>	<div>42</div> <div>Mo</div> <div>molybdenum</div> <div>96</div>	<div>43</div> <div>Tc</div> <div>technetium</div> <div>—</div>	<div>44</div> <div>Ru</div> <div>ruthenium</div> <div>101</div>	<div>45</div> <div>Rh</div> <div>rhodium</div> <div>103</div>	<div>46</div> <div>Pd</div> <div>palladium</div> <div>106</div>	<div>47</div> <div>Ag</div> <div>silver</div> <div>108</div>	<div>48</div> <div>Cd</div> <div>cadmium</div> <div>112</div>	<div>49</div> <div>In</div> <div>indium</div> <div>115</div>	<div>50</div> <div>Sn</div> <div>tin</div> <div>119</div>	<div>51</div> <div>Sb</div> <div>antimony</div> <div>122</div>	<div>52</div> <div>Te</div> <div>tellurium</div> <div>128</div>	<div>53</div> <div>I</div> <div>iodine</div> <div>127</div>	<div>54</div> <div>Xe</div> <div>xenon</div> <div>131</div>
<div>55</div> <div>Cs</div> <div>caesium</div> <div>133</div>	<div>56</div> <div>Ba</div> <div>barium</div> <div>137</div>	57–71 lanthanoids	<div>72</div> <div>Hf</div> <div>hafnium</div> <div>178</div>	<div>73</div> <div>Ta</div> <div>tantalum</div> <div>181</div>	<div>74</div> <div>W</div> <div>tungsten</div> <div>184</div>	<div>75</div> <div>Re</div> <div>rhenium</div> <div>186</div>	<div>76</div> <div>Os</div> <div>osmium</div> <div>190</div>	<div>77</div> <div>Ir</div> <div>iridium</div> <div>192</div>	<div>78</div> <div>Pt</div> <div>platinum</div> <div>195</div>	<div>79</div> <div>Au</div> <div>gold</div> <div>197</div>	<div>80</div> <div>Hg</div> <div>mercury</div> <div>201</div>	<div>81</div> <div>Tl</div> <div>thallium</div> <div>204</div>	<div>82</div> <div>Pb</div> <div>lead</div> <div>207</div>	<div>83</div> <div>Bi</div> <div>bismuth</div> <div>209</div>	<div>84</div> <div>Po</div> <div>polonium</div> <div>—</div>	<div>85</div> <div>At</div> <div>astatine</div> <div>—</div>	<div>86</div> <div>Rn</div> <div>radon</div> <div>—</div>
<div>87</div> <div>Fr</div> <div>francium</div> <div>—</div>	<div>88</div> <div>Ra</div> <div>radium</div> <div>—</div>	89–103 actinoids	<div>104</div> <div>Rf</div> <div>rutherfordium</div> <div>—</div>	<div>105</div> <div>Db</div> <div>dubnium</div> <div>—</div>	<div>106</div> <div>Sg</div> <div>seaborgium</div> <div>—</div>	<div>107</div> <div>Bh</div> <div>bohrium</div> <div>—</div>	<div>108</div> <div>Hs</div> <div>hassium</div> <div>—</div>	<div>109</div> <div>Mt</div> <div>meitnerium</div> <div>—</div>	<div>110</div> <div>Ds</div> <div>darmstadtium</div> <div>—</div>	<div>111</div> <div>Rg</div> <div>roentgenium</div> <div>—</div>	<div>112</div> <div>Cn</div> <div>copernicium</div> <div>—</div>	<div>113</div> <div>Nh</div> <div>nihonium</div> <div>—</div>	<div>114</div> <div>Fl</div> <div>flerovium</div> <div>—</div>	<div>115</div> <div>Mc</div> <div>moscovium</div> <div>—</div>	<div>116</div> <div>Lv</div> <div>livermorium</div> <div>—</div>	<div>117</div> <div>Ts</div> <div>tennessine</div> <div>—</div>	<div>118</div> <div>Og</div> <div>oganesson</div> <div>—</div>

lanthanoids

<div>57</div> <div>La</div> <div>lanthanum</div> <div>139</div>	<div>58</div> <div>Ce</div> <div>cerium</div> <div>140</div>	<div>59</div> <div>Pr</div> <div>praseodymium</div> <div>141</div>	<div>60</div> <div>Nd</div> <div>neodymium</div> <div>144</div>	<div>61</div> <div>Pm</div> <div>promethium</div> <div>—</div>	<div>62</div> <div>Sm</div> <div>samarium</div> <div>150</div>	<div>63</div> <div>Eu</div> <div>europium</div> <div>152</div>	<div>64</div> <div>Gd</div> <div>gadolinium</div> <div>157</div>	<div>65</div> <div>Tb</div> <div>terbium</div> <div>159</div>	<div>66</div> <div>Dy</div> <div>dysprosium</div> <div>163</div>	<div>67</div> <div>Ho</div> <div>holmium</div> <div>165</div>	<div>68</div> <div>Er</div> <div>erbium</div> <div>167</div>	<div>69</div> <div>Tm</div> <div>thulium</div> <div>169</div>	<div>70</div> <div>Yb</div> <div>ytterbium</div> <div>173</div>	<div>71</div> <div>Lu</div> <div>lutetium</div> <div>175</div>
<div>89</div> <div>Ac</div> <div>actinium</div> <div>—</div>	<div>90</div> <div>Th</div> <div>thorium</div> <div>232</div>	<div>91</div> <div>Pa</div> <div>protactinium</div> <div>231</div>	<div>92</div> <div>U</div> <div>uranium</div> <div>238</div>	<div>93</div> <div>Np</div> <div>neptunium</div> <div>—</div>	<div>94</div> <div>Pu</div> <div>plutonium</div> <div>—</div>	<div>95</div> <div>Am</div> <div>americium</div> <div>—</div>	<div>96</div> <div>Cm</div> <div>curium</div> <div>—</div>	<div>97</div> <div>Bk</div> <div>berkelium</div> <div>—</div>	<div>98</div> <div>Cf</div> <div>californium</div> <div>—</div>	<div>99</div> <div>Es</div> <div>einsteinium</div> <div>—</div>	<div>100</div> <div>Fm</div> <div>fermium</div> <div>—</div>	<div>101</div> <div>Md</div> <div>mendelevium</div> <div>—</div>	<div>102</div> <div>No</div> <div>nobelium</div> <div>—</div>	<div>103</div> <div>Lr</div> <div>lawrencium</div> <div>—</div>

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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