

Form Class	Teaching Group	Name and Index Number
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PEI HWA SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2021
Secondary Four Express

CHEMISTRY

6092/01

Paper 1 Multiple Choice

31 August 2021

1 hour

Additional Materials :

Optical Answer Sheet (OTAS)

READ THESE INSTRUCTIONS FIRST

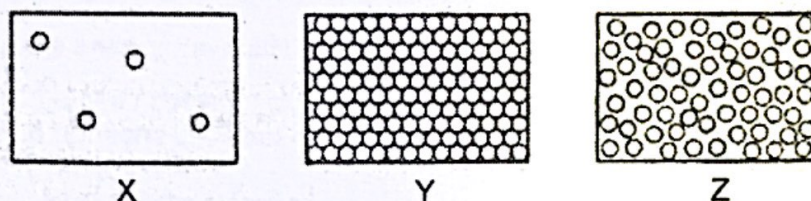
Do not open this booklet until you are told to do so.

This booklet consists of only questions for MCQs.

1. Write your name, class and index number in the spaces above and on the OTAS. Shade your index number in the boxes.
2. There are **40** questions in 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 provided.
3. Each correct answer will score one mark. A mark will not be deducted for a wrong answer. Any rough working should be done on this booklet.
4. **Hand in the OTAS separately from the question booklet.**
5. A copy of the Periodic Table is printed on page 15.

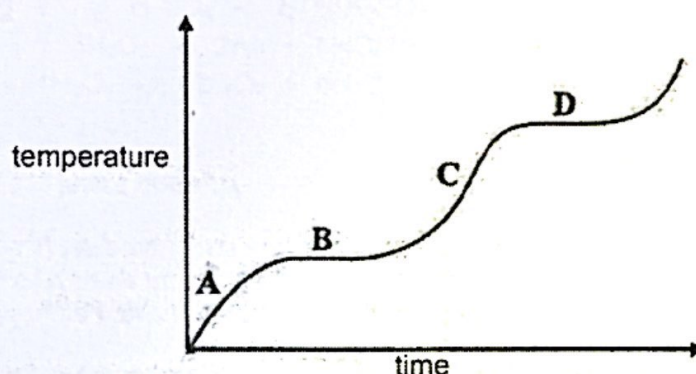
This question paper consists of **15** printed pages, including this cover page.

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



The graph shows the temperature changes which occur on warming the substance.

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



- 2 A new substance was discovered and a series of experiments were conducted on it.

Which observation confirms that it is not an element?

- A It conducts electricity.
 B It has a fixed melting point.
 C When heated in air, it forms two oxides.
 D Electrolysis of the molten substance formed two products.
- 3 The table shows some mixtures and their constituents are obtained using suitable separation techniques.

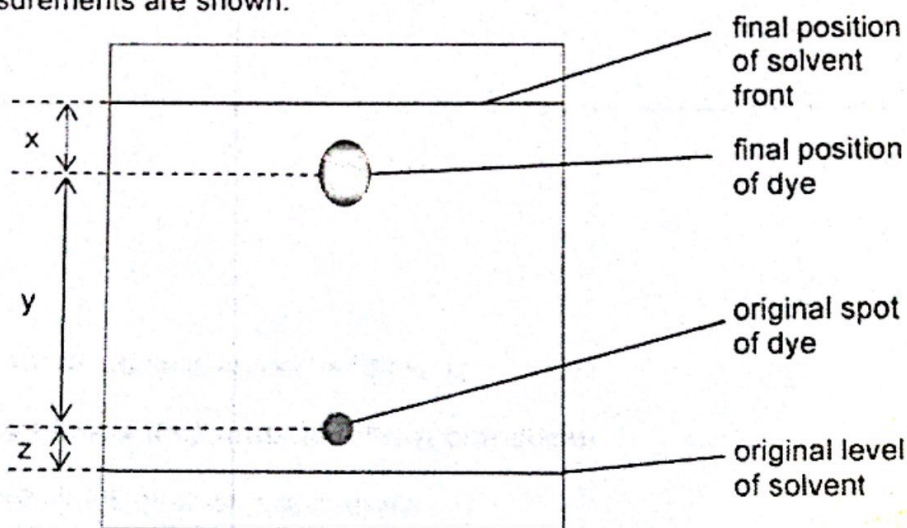
	mixture	constituent obtained
1	NaCl (aq)	H ₂ O (l)
2	I ₂ (s) and Ni (s)	I ₂ (s)
3	NaCl (aq)	NaCl (s)

Which row shows the correct separation techniques to obtain the constituents from the mixture?

	1	2	3
A	distillation	sublimation	evaporation
B	distillation	sublimation	filtration
C	filtration	crystallisation	evaporation
D	sublimation	crystallisation	filtration

- 4 The diagram shows the chromatogram obtained by analysis of a single dye.

Three measurements are shown.



How is the R_f value of the dye calculated?

A $\frac{x}{x+y}$

B $\frac{y}{x+y}$

C $\frac{x}{x+y+z}$

D $\frac{y}{x+y+z}$

- 5 Which of the following substances contain delocalised electrons?

- 1 copper
- 2 alloy of copper and zinc
- 3 solid copper(II) chloride
- 4 molten copper(II) chloride

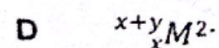
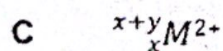
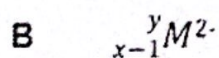
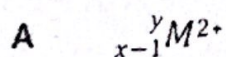
- A 1 and 2
 B 2 and 3
 C 3 and 4
 D 1, 2 and 4

- 6 A newly found atom of element M has the following subatomic particles.

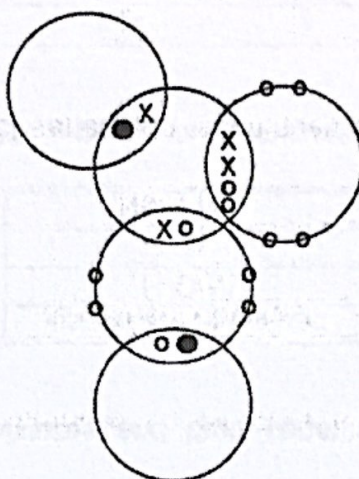
x : number of electrons
 y : number of neutrons

It is placed in the same group as barium.

Which of the following correctly represents the symbol for the ion of M ?



- 7 The diagram below shows the arrangement of electrons in the outermost shells of the atoms in a compound. The atoms are from the first twenty elements in the Periodic Table.



Which of the following statements about the compound is true?

- A It contains carbon and hydrogen atoms only.
- B It contains single bonds between the atoms only.
- C It contains a Group I element.
- D It contains oxygen.

- 8 Elements U and V are in Group VII of the Periodic Table.

U is a liquid at room temperature. V is a solid at room temperature.

- 1 Atoms of V have more protons than atoms of U.
- 2 Molecules of V have more atoms than molecules of U.
- 3 V displaces U from aqueous solutions of U^- ions.

Which statement(s) is/are correct?

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

- 9 Caesium is a Group I metal.

Which reaction involving this element would **not** produce hydrogen?

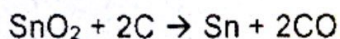
- A adding caesium to ethanoic acid
- B adding caesium to water
- C electrolysis of aqueous caesium chloride
- D electrolysis of molten caesium chloride

- 10 A solid, R, has a melting point of 734°C . It can only conduct electricity when molten or in aqueous solution. It is soluble in water but not in organic solvent.

Which of the following is likely to be R?

- A diamond
- B graphite
- C potassium bromide
- D zinc

- 11 Tin is extracted from tin ore that contains SnO_2 ($M_r = 151$) by reducing it with coal in a furnace according to the chemical equation.



What is the percentage purity of tin ore if 600 g of SnO_2 on reduction produces 82 g of tin?

- A 17.3%
- B 34.6%
- C 41.3%
- D 82.6%

- 12 Which of the following has 7.2×10^{23} atoms?

- A 0.2 mol of magnesium metal
- B 0.3 mol of ammonia gas
- C 3.0 mol of carbon dioxide gas
- D 4.0 mol of hydrogen chloride

- 13 A hydrocarbon contains hydrogen and carbon atoms only. When burnt in oxygen, carbon dioxide gas and water vapour is formed. A pure hydrocarbon was completely isolated from bottled gas used for cooking. When 10 cm^3 of the hydrocarbon was burnt in 70 cm^3 of oxygen, the final gaseous mixture contained 30 cm^3 of carbon dioxide and 20 cm^3 of unreacted oxygen. All gaseous volumes were measured under identical conditions.

What is the formula of the hydrocarbon?

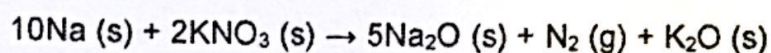
- A C_2H_6
- B C_3H_6
- C C_3H_8
- D C_4H_{10}

- 14 The formula of an oxide is Z_2O_3 and its mass is 12.0 g. The percentage by mass of Z in Z_2O_3 is 70%.

Which of the expression below shows the number of moles of Z in 12.0 g of the oxide?

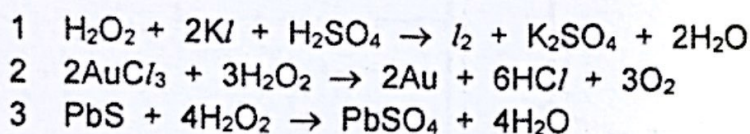
- A $\frac{12.0}{16} \times \frac{2}{3}$
- B $\frac{8.4}{16} \times \frac{2}{3}$
- C $\frac{3.6}{16} \times \frac{2}{3}$
- D $\frac{3.6}{16} \times \frac{3}{2}$

- 15 Sodium reacts with potassium nitrate according to the equation below.



Which element has undergone oxidation in the above reaction?

- A nitrogen
 - B oxygen
 - C potassium
 - D sodium
- 16 Hydrogen peroxide can function as an oxidising agent or a reducing agent. In which reaction is it acting as an oxidising agent?



- A 1 only
 - B 2 only
 - C 3 only
 - D 1 and 3 only
- 17 Brass is an alloy of copper and zinc.

Which statement is correct?

- A Brass can be represented by a chemical formula.
 - B Brass is more ductile and malleable compared to zinc.
 - C The zinc in brass will react with dilute hydrochloric acid.
 - D Brass is formed by a chemical reaction between copper and zinc.
- 18 Metals P, Q, R and S are found to have the following properties.
- 1 Only oxides of P and R can be reduced by heating with carbon.
 - 2 P and Q react with acid but not with cold water. R does not react both with acid and water.
 - 3 Carbonate of S is stable to heat.

The order of increasing reactivity of the four metals is:

- A R, P, S, Q
- B S, Q, P, R
- C R, P, Q, S
- D P, Q, R, S

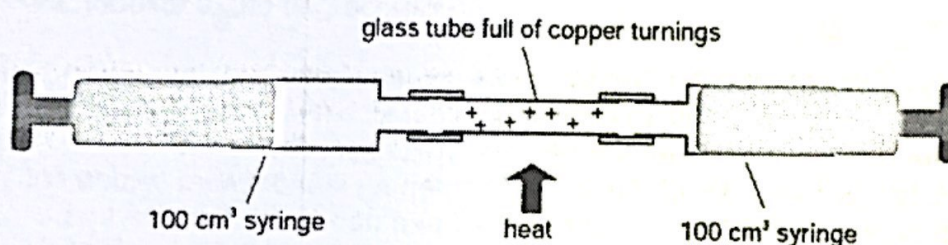
- 19 The table shows the results of adding weighed pieces of zinc to solutions Y and Z.

solution used	initial mass of zinc / g	mass of zinc after 20 minutes / g
Y	5	5
Z	5	4

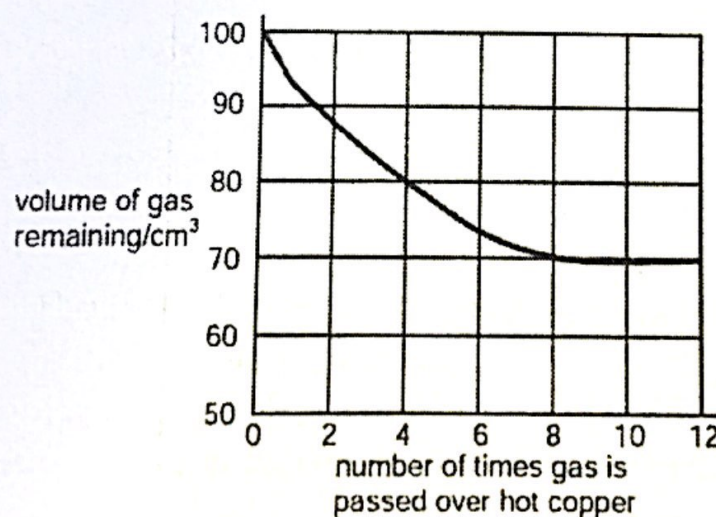
What could the aqueous solutions Y and Z have been?

	Y	Z
A	silver nitrate	iron(II) sulfate
B	dilute hydrochloric acid	sodium chloride
C	magnesium chloride	potassium nitrate
D	calcium chloride	copper(II) sulfate

- 20 A 100 cm³ sample of bottled gas used for diving was placed in a gas syringe in the apparatus shown.



The gas was passed backward and forward over heated copper turnings in a glass tube. The results obtained were used to plot the graph.



What is the percentage of oxygen in the bottled gas?

- A 20%
- B 30%
- C 70%
- D 80%

21 Which method(s) is/are suitable to distinguish between 1.0 mol/dm^3 of aqueous hydrochloric acid and 1.0 mol/dm^3 of aqueous ethanoic acid?

- 1 using a pH meter
- 2 determining the volume of 1.0 mol/dm^3 of sodium hydroxide solution used to neutralise 25.0 cm^3 of the acids separately
- 3 measuring the total volume of hydrogen gas formed when excess magnesium is added to the acids separately

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

22 A solution contains barium ions and silver ions and one type of anion.

What could the anion be?

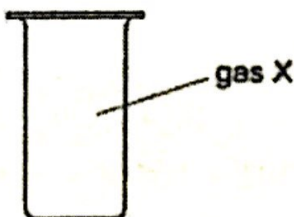
- A chloride only
B nitrate only
C sulfate only
D chloride or nitrate or sulfate

23 When heated, two moles of X gives one mole of oxygen and two moles of chlorine.

Determine the molecular formula of X.

- A ClO_2
B Cl_2O
C Cl_2O_2
D Cl_4O_2

24 X is a monatomic gas.



Which of the following statements about gas X is true?

- A X burns in air.
B X is coloured.
C X is unreactive.
D X will displace iodine from potassium iodide.

- 25 A student carried out the following reactions on a sample of ammonium nitrate:

- 1 heating with aqueous sodium hydroxide
- 2 heating with aluminium and aqueous sodium hydroxide
- 3 heating with dilute hydrochloric acid
- 4 heating with water

Which of the above reactions will produce an alkaline gas that turns damp red litmus blue?

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

- 26 Which of the following shows the sources of nitrogen and hydrogen in the manufacture of ammonia?

	nitrogen	hydrogen
A	fertilisers	crude oil
B	crude oil	water
C	air	crude oil
D	air	air

- 27 To grow rose plants, a fertiliser containing nitrogen, phosphorus and potassium is often used.

To grow the best rose flowers, the fertiliser should contain a high proportion of potassium.

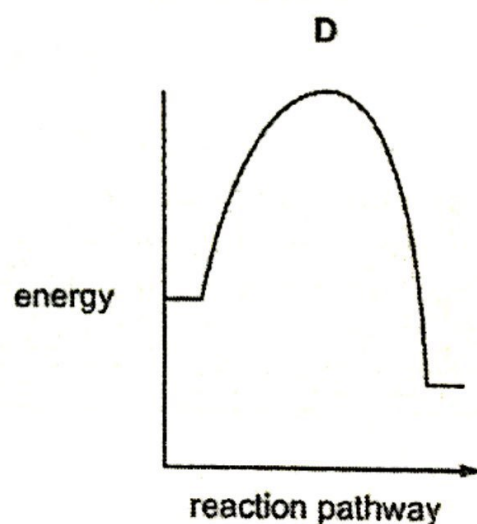
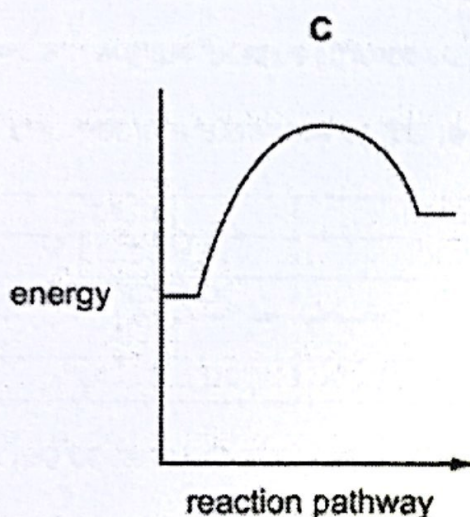
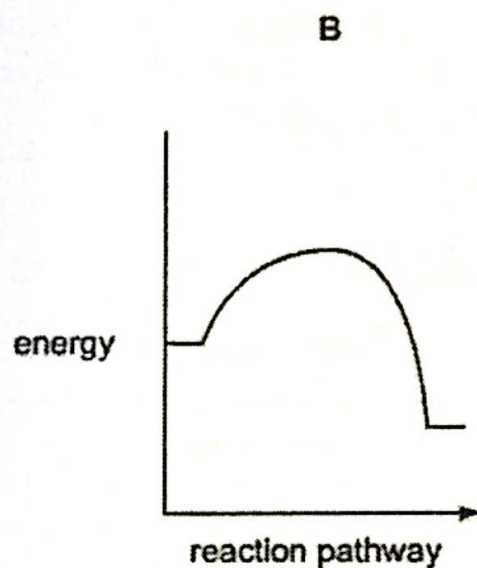
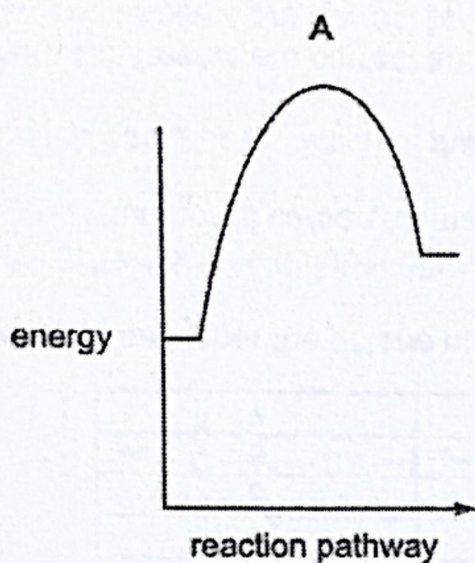
Which fertiliser is best for producing rose flowers?

fertiliser	proportion by mass		
	N	P	K
A	9	0	25
B	13	13	20
C	29	5	0
D	29	15	5

- 28 Which change is endothermic?

- A $\text{CaCO}_3 (\text{s}) \rightarrow \text{CaO} (\text{s}) + \text{CO}_2 (\text{g})$
 B $\text{H} (\text{g}) + \text{Cl} (\text{g}) \rightarrow \text{HCl} (\text{g})$
 C $\text{Mg} (\text{s}) + 2\text{HCl} (\text{aq}) \rightarrow \text{MgCl}_2 (\text{aq}) + \text{H}_2 (\text{g})$
 D $\text{H}_2\text{O} (\text{l}) \rightarrow \text{H}_2\text{O} (\text{s})$

29 Which reaction profile shows the **slowest** exothermic reaction?



30 A student wishes to investigate the effect of acid concentration on the speed of the reaction between a given mass of calcium carbonate and an excess of hydrochloric acid.

Which measurement would **not** allow him to achieve the aim of his investigation?

- A** change in the mass of the reaction mixture with time
- B** final temperature of the reaction mixture
- C** time taken for a given volume of gas to be collected
- D** volume of gas produced in a given time

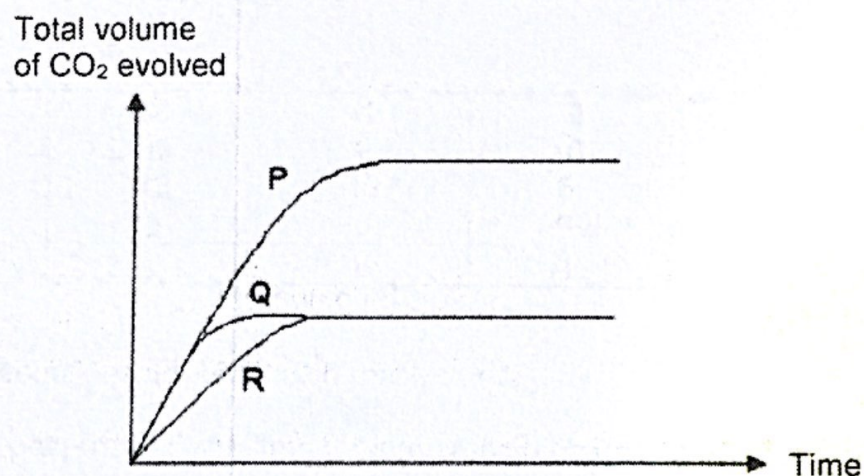
- 31 The effect of the concentration of an acid on the rate of carbon dioxide gas released in an acid-carbonate reaction was investigated.

The total volume of carbon dioxide evolved was recorded against time.

In each experiment, an excess mass of carbonate is used to react with hydrochloric acid with the given volume and concentration as stated in the table:

Experiment I	40 cm ³ of 1.0 mol/dm ³ hydrochloric acid
Experiment II	20 cm ³ of 2.0 mol/dm ³ hydrochloric acid
Experiment III	40 cm ³ of 2.0 mol/dm ³ hydrochloric acid

The graphs of total volume of carbon dioxide evolved against time were plotted below.



Which of the graphs P, Q and R show the total volume of carbon dioxide produced in Experiment I, II and III over the time?

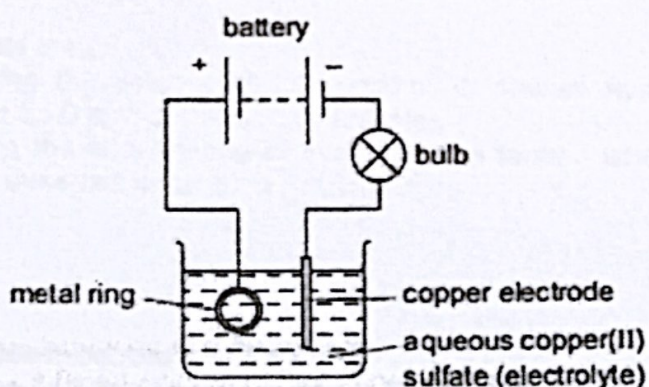
	Experiment I	Experiment II	Experiment III
A	P	Q	R
B	P	R	Q
C	R	Q	P
D	Q	P	R

- 32 It has been suggested that the cars of the future could be powered by fuel cells. One type of fuel cell uses the chemical reaction between oxygen and hydrogen to produce electricity.

What would be a disadvantage of using this type of fuel cell to power a car?

- A A car cannot be powered by electricity.
- B The hydrogen tank might split in an accident, leading to an explosion.
- C The product of the reaction between oxygen and hydrogen is toxic.
- D The oxygen would need to be obtained from air.

- 33 The diagram shows apparatus used in an attempt to electroplate a metal ring with copper.



The experiment did not work.

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

- A add solid copper(II) sulfate to the electrolyte
- B increase the temperature of the electrolyte
- C replace the copper electrode with a carbon electrode
- D reverse the connections to the battery

- 34 When crude oil is distilled, several products are obtained.

What is the correct order of their boiling points?

	highest boiling point → lowest boiling point			
A	diesel	paraffin	lubricating oil	petrol
B	lubricating oil	diesel	paraffin	petrol
C	paraffin	petrol	lubricating oil	diesel
D	petrol	paraffin	diesel	lubricating oil

- 35 Octane number is a measure of the tendency of a fuel to auto-ignite.

The table shows the octane number of several hydrocarbons.

number of carbon atoms	octane number	
	alkane	alkene
4	94	98
5	62	93
6	25	85
7	0	75

Statement 1: The higher the octane number of a hydrocarbon, the better it burns.

Statement 2: The octane number of an alkane is lower than that of an alkene with the same number of carbon atoms.

Based on the data above, which of the following is correct?

- A Both statements are correct and statement 2 explains statement 1.
- B Both statements are correct but statement 2 does not explain statement 1.
- C Statement 1 is correct but statement 2 is incorrect.
- D Statement 2 is correct but statement 1 is incorrect.

36 How many of the following statements about ethanol are correct?

- 1 molecular formula is C_2H_6O
- 2 manufactured from ethane and steam
- 3 oxidises to ethanoic acid
- 4 produced by the fermentation of glucose
- 5 used as a fuel
- 6 used as a solvent

- A 3
B 4
C 5
D 6

37 In the polymerisation of ethene to form poly(ethene), which does not change?

- A boiling point
B density
C empirical formula
D molecular mass

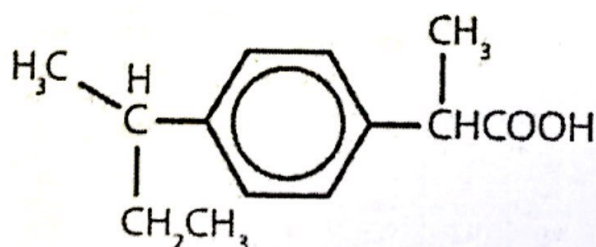
38 Recent medical studies have suggested that oils made up of polyunsaturated fatty acids are healthier than those with saturated ones. Oleic acid is an example of polyunsaturated fatty acids.

In the analysis of oleic acid (relative molecular mass, $M_r = 280$), it is found that 56.0 g of the acid requires 0.8 g of hydrogen gas for complete reaction.

What is the number of carbon-carbon double bonds in a molecule of oleic acid?

- A 1
B 2
C 3
D 4

39 Ibuprofen is a drug used as an alternative to aspirin for the relief of pain, fever and inflammation. The structure of ibuprofen is shown below.

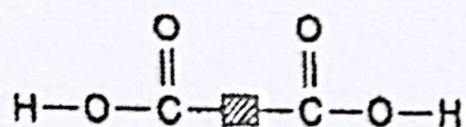


Which of the following statements about ibuprofen is not correct?

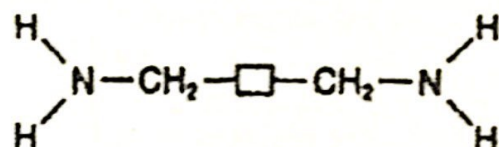
- A It liberates carbon dioxide with sodium carbonate solution.
B It liberates hydrogen with magnesium metal.
C It undergoes esterification with ethanol.
D It undergoes oxidation with acidified potassium manganate(VII).



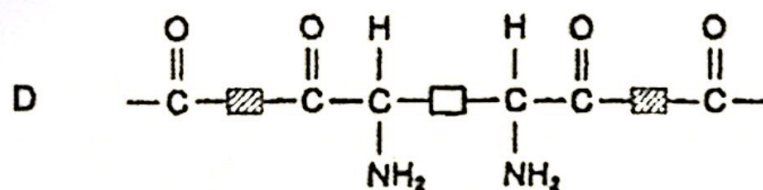
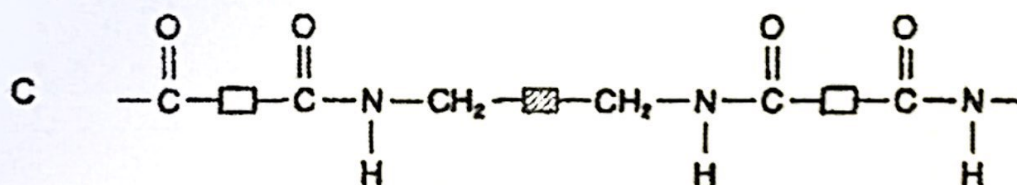
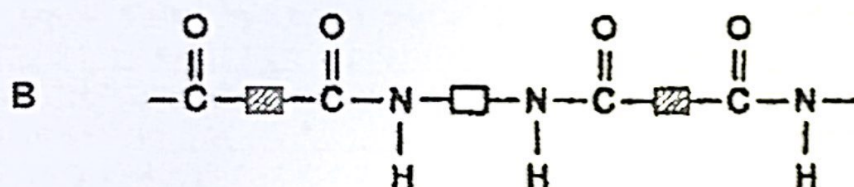
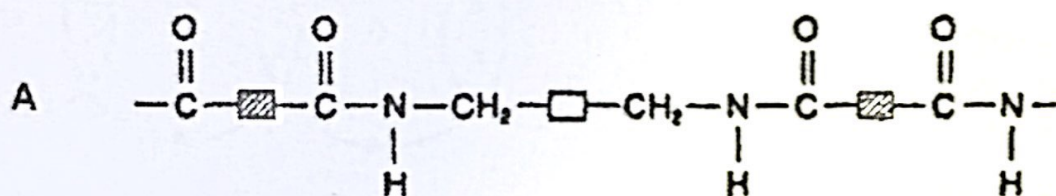
- 40 A polymer is made from the two monomers shown.



and



Which diagram shows the structure of the polymer?



DATA SHEET The Periodic Table of the Elements

Periodic Table of the Elements																		
Group												III	IV	V	VI	VII	0	
I	II											1 H Hydrogen 1						2 He Helium 4
Key proton (atomic) number atomic symbol name relative atomic mass																		
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											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 Cesium 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 -	90 - 103 actinoids	104 Rf Rutherfordium -	105 Db Dubnium -	106 Sg Seaborgium -	107 Bh Bohrium -	108 Hs Hassium -	109 Mt Mendelevium -	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 227	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 -	

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

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.).