SINGAPORE CHINESE GIRLS' SCHOOL
PRELIMINARY EXAMINATION
SECONDARY FOUR

CANDIDATE NAME

CLASS 4

REGISTER NUMBER

CENTRE NUMBER

INDEX NUMBER

CHEMISTRY 6092/01

PAPER 1 Multiple Choice

28 August 2024
1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the Answer Sheet in the spaces provided.

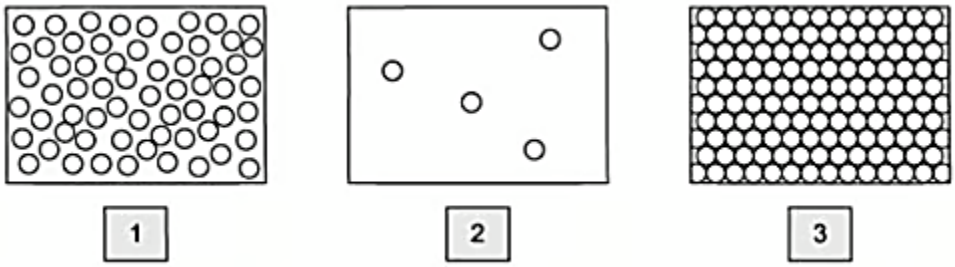
There are **forty** questions in this paper. Answer **all** questions. For each question, there are four possible answers, **A**, **B**, **C**, **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 booklet.
A copy of the Periodic Table is printed on page 17.
The use of an approved scientific calculator is expected, where appropriate.

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1 Substance **X** can occur in three different physical states as shown in the diagram.



Which statement is correct?

A In state 1, the particles vibrate in fixed positions.
B Diffusion occurs in the phase change from state 3 to state 2.
C The volume of the substance in state 1 is fixed.
D Condensation occurs in the phase change from state 1 to state 2.

2 The rate of diffusion of two gases, methane and propene, is investigated.
Which gas diffuses at a faster rate and why?

	Faster gas	Reason
A	propene	It is unsaturated so is more reactive.
B	propene	It is lighter so moves faster.
C	methane	It has a lower molecular mass.
D	methane	It has a lower boiling point.

3 The table gives the results of chromatography experiments that were carried out on some known food colours, using the same solvent.

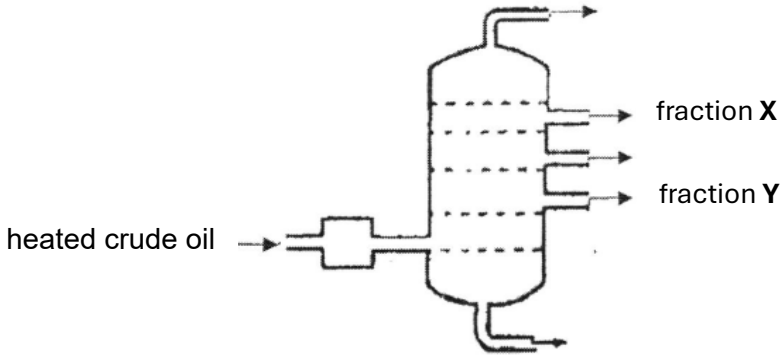
Name of food colour	Distance form start line to solvent front (mm)	Distance moved by food colour spot (mm)
Ponceau 4R	60	42
Carmoisine	74	45
Fast red	67	27
Erythrosine	58	17

Which food colour is the most soluble in the solvent used?

A Ponceau 4R
B Carmoisine
C Fast red
D Erythrosine

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4 The diagram shows the fractional distillation of crude oil.

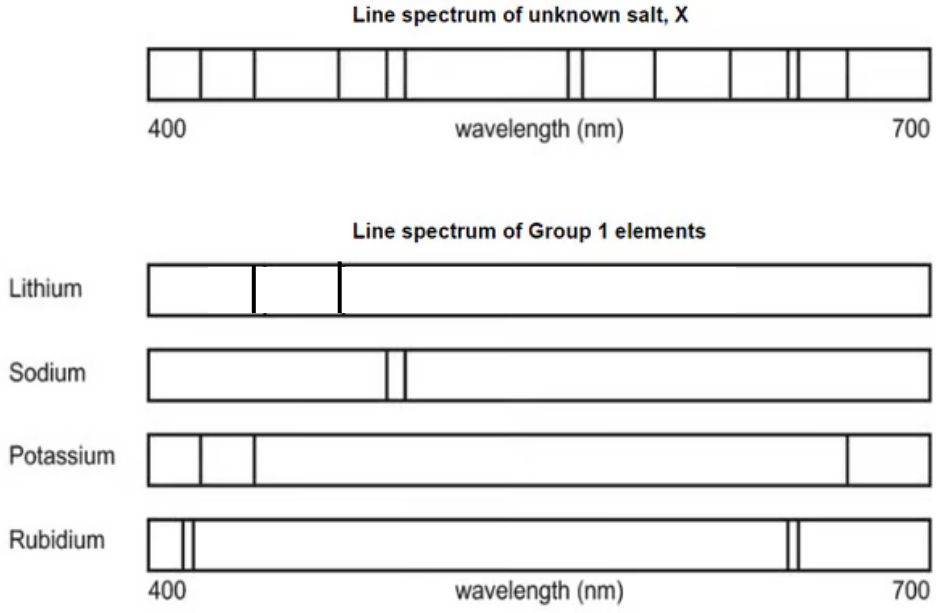


Which statement about fractions **X** and **Y** is correct?

A **X** is more flammable than **Y**.
B **X** is more viscous than **Y**.
C **X** burns with a sootier flame than **Y**.
D **X** has longer chain molecules than **Y**.

5 An unknown salt sample, **X**, has been sent off for analysis and identification using flame emission spectroscopy. In this kind of spectroscopy, atoms of an element each give a characteristic pattern of lines which is known as a line spectrum.

A small sample of **X** loaded into a flame emission spectroscope and its line spectrum was generated. The line spectrum of **X** was compared to the line spectrums of Group 1 elements to see if the metal ions present in **X** could be identified. The line spectra are shown below.



Which element is not present in **X**?

A Lithium
B Sodium
C Potassium
D Rubidium

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6 A student reacted excess calcium with hydrochloric acid and carried out a series of tests on the reaction mixture. The results of the tests are given in the table.

Which observation does not tell you that this reaction has occurred?

	Test	Observation
A	Add dilute nitric acid followed by aqueous silver nitrate	White precipitate
B	Weigh the reaction mixture at the start and at the end	Mass decreases
C	Test the pH of the mixture at the start and after 30 s	pH increases
D	Add aqueous sodium hydroxide until no further change	White precipitate insoluble in excess sodium hydroxide

7 Elements **X** and **Y** combine to form an ionic compound.
Atoms of **X** have more protons than atoms of **Y**.
Atoms of **Y** have more valence electrons than atoms of **X**.

Which statement is correct?

A Ions of **X** are negatively charged.
B Atoms of **X** have more electron shells than atoms of **Y**.
C **X** and **Y** are in the same period of the Periodic Table.
D **X** and **Y** are in the same group of the Periodic Table.

8 Iridium has two isotopes, ^{191}Ir and ^{193}Ir. The percentage abundance of each isotope in a sample of iridium is given in the table.

Mass number	191	193
Percentage abundance	62.7%	37.3%

What is the relative atomic mass of the sample of iridium?

A 191.2
B 191.6
C 191.7
D 192.5

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9 A selenide ion has the following notation.

$$^{79}_{34}Se^{2-}$$

Which row correctly describes the sub-atomic particles in the selenide ion?

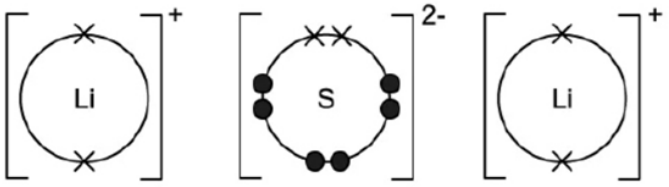
	Protons	Neutrons	Electrons
A	32	79	34
B	34	45	32
C	34	45	36
D	45	34	36

10 Which element does not form a stable ion with the same electronic configuration as neon?

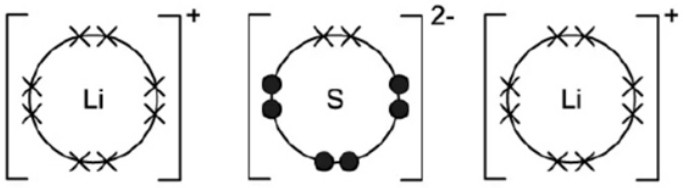
A Magnesium
B Fluorine
C Sodium
D Sulfur

11 Which of the dot-and-cross diagrams shows the correct arrangement of electrons in the valence shells of lithium sulfide?

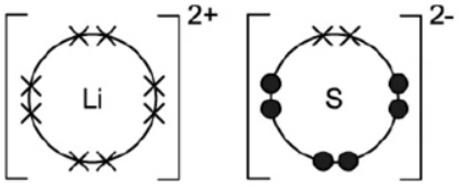
A



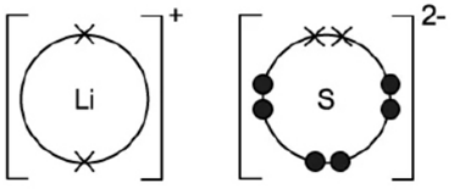
B



C



D



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12 CH_4, H_2O and HCl are covalent compounds.

Which atoms in these compounds do not use all their outer shell electrons in bonding?

A C and H
B C and O
C O and Cl
D Cl and C

13 An impure sample of calcium carbonate with a mass of 1.70 g was reacted with excess hydrochloric acid and 360 cm^3 of carbon dioxide was collected at room temperature and pressure.

What is the percentage purity of the calcium carbonate?

A 75%
B 88%
C 90%
D 98%

14 The relative molecular masses of four compounds are given.
A student has a 1.0 g sample of each compound.

Which sample contains the highest number of moles of oxygen atoms?

	compound	relative molecular mass
A	Al_2O_3	102
B	CuO	80
C	H_2SO_4	98
D	HNO_3	63

15 50.0 cm^3 of 0.10 mol/dm^3 silver nitrate, $AgNO_3$, is added to 150.0 cm^3 of 0.05 mol/dm^3 of sodium iodide, NaI, in a beaker.

After the reaction, solid silver iodide is present in the beaker. What else is present in the mixture?

A Ag^+, Na^+, NO_3^- only
B Na^+, I^-, NO_3^- only
C Na^+, I^- only
D Na^+, NO_3^- only

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16 Water is formed when oxygen combines with hydrogen. What mass of oxygen combines with 6 g of hydrogen?

A 12 g
B 48 g
C 96 g
D 144 g

17 Which compound has the lowest percentage by mass of nitrogen?

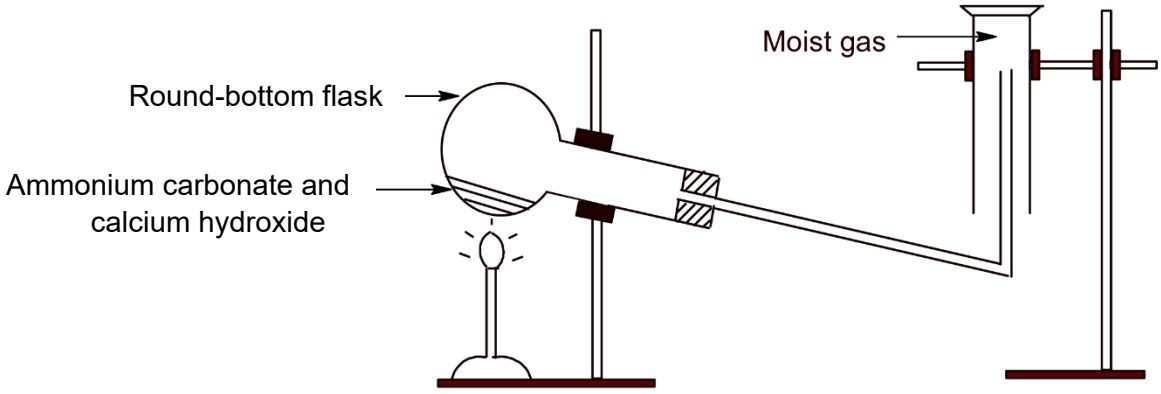
A $(NH_2)_2CO$
B $(NH_4)_2SO_4$
C $(NH_4)_3PO_4$
D NH_4NO_3

18 Cobalt(II) chloride is a soluble salt. What reactants could be used to produce cobalt(II) chloride and what is a suitable method to produce a pure sample of the salt?

	Reactants	Method
A	cobalt(II) nitrate and hydrochloric acid	excess solid + acid
B	cobalt(II) hydroxide and sodium chloride	titration
C	cobalt(II) sulfate and sodium chloride	precipitation
D	cobalt(II) carbonate and hydrochloric acid	excess solid + acid

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19 Ammonium carbonate reacts with calcium hydroxide to produce a colourless, pungent gas. The set-up for preparation and collection of a moist sample of the gas is shown.



Which statements about the moist gas are correct? The gas

1 turns universal indicator blue
2 is denser than air
3 is very soluble in water
4 can be dried by passing it through concentrated sulfuric acid

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

20 Which property of elements increases from left to right of Period 3 of the Periodic Table?

A number of outer shells
B metallic character
C tendency to get reduced
D melting points

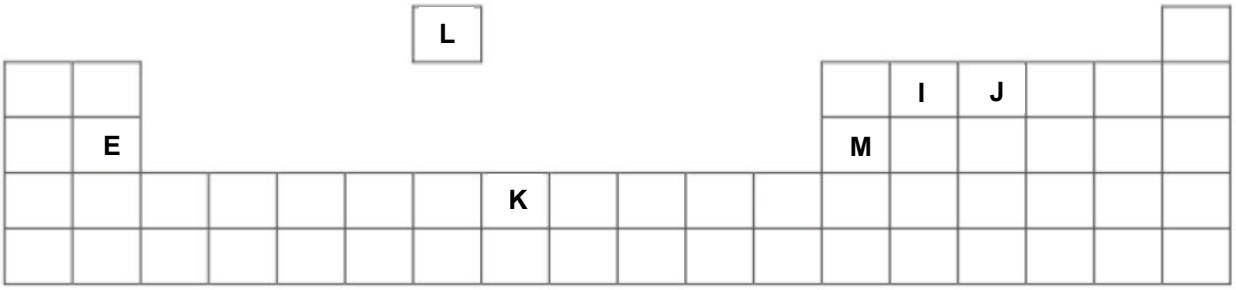
21 A solution of a lithium halide and a halogen are mixed. A reaction occurs and the mixture darkens in colour.

What are the reactants?

A bromine and lithium chloride
B iodine and lithium fluoride
C chlorine and lithium iodide
D chlorine and lithium fluoride

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22 Part of the Periodic Table is shown. The letters are not symbols of the elements.



Which statement is correct?

A **I** and **L** can react with oxygen to form neutral oxides.
B **E** and **K** react with acids to form coloured salts.
C **E** and **M** form chlorides that conduct electricity at room temperature.
D **J** reacts with **M** to form a covalent compound with formula MJ.

23 The following section of the reactivity series shows a newly discovered element Y.

Ca

Mg

Fe

Y

H

Cu

The carbonate of Y has the formula YCO_3.

Which of the equations shows a reaction that would take place?

A $2Y(s) + Cu^{2+}(aq) \rightarrow 2Y^{+}(aq) + Cu(s)$
B $3Y(s) + Fe_2O_3(s) \rightarrow 2Fe(s) + 3YO(s)$
C $YOH(aq) + HCl(aq) \rightarrow YCl(aq) + H_2O(l)$
D $YO(s) + CO(g) \rightarrow Y(s) + CO_2(g)$

24 Solder is an alloy of lead and tin.
Which statement about solder is correct?

A It can be represented by the chemical formula, PbSn.
B It has a higher melting point than lead and tin.
C It consists of positive ions in a sea of delocalised electrons.
D It is formed by a chemical reaction between lead and tin.

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25 Attaching pieces of magnesium to underground iron pipes can protect the iron from corrosion. Which reaction protects the iron from corrosion?

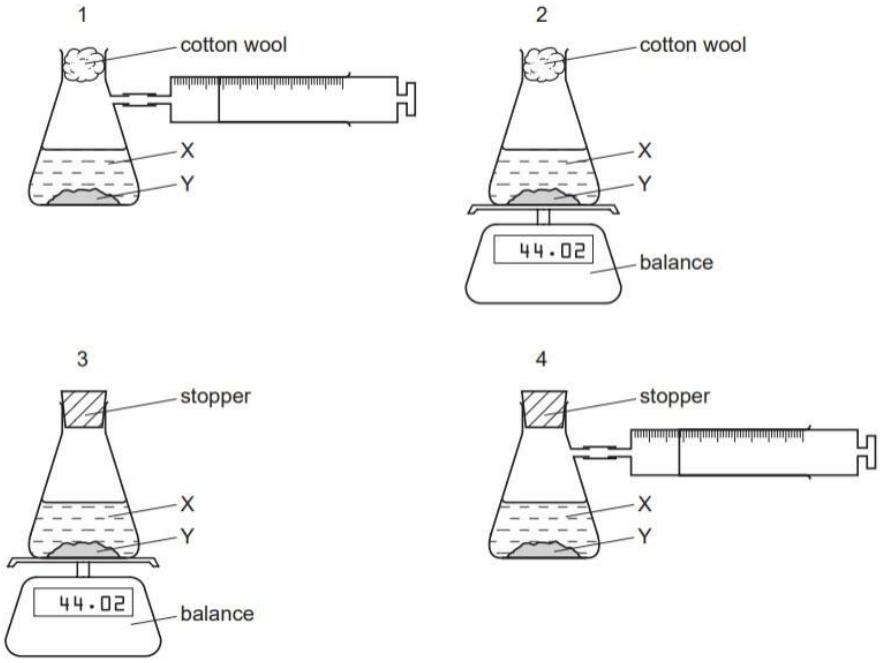
A $Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$

B $Fe(s) \rightarrow Fe^{2+}(aq) + 2e^-$

C $Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$

D $Mg(s) \rightarrow Mg^{2+}(aq) + 2e^-$

26 A liquid **X** reacts with solid **Y** to form a gas.



Which two diagrams show suitable methods for investigating the speed of the reaction?

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

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27 In an experiment, a student reacted excess magnesium with 100 cm^3 of 1.0 mol/dm^3 of acids **P** and **Q** in separate conical flasks.

The following observations were recorded.

1. Acid **P** produces the gas at a faster rate than acid **Q**.
2. Both reactions produced the same volume of gas at the end of the reaction.

What could acids **P** and **Q** be?

	Acid **P**	Acid **Q**
A	hydrochloric acid	propanoic acid
B	sulfuric acid	hydrochloric acid
C	propanoic acid	nitric acid
D	sulfuric acid	propanoic acid

28 Four electrolytes are listed. Each is electrolysed using inert electrodes.
How many of these electrolytes would produce a colourless gas at both the cathode and anode?

- dilute aqueous copper(II) chloride
- dilute aqueous iron(II) chloride
- concentrated hydrochloric acid
- dilute aqueous sodium hydroxide

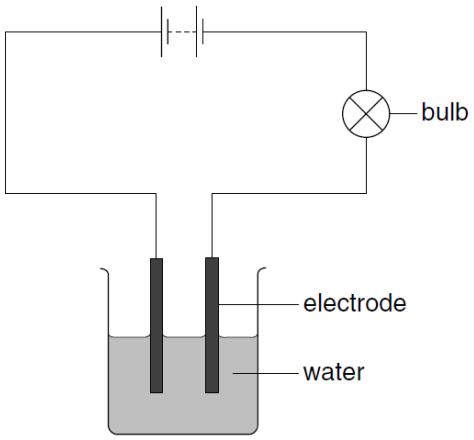
A 1 **B** 2 **C** 3 **D** 4

29 Which statement about the electrolysis of molten magnesium chloride is incorrect?

A Magnesium ions gain electrons at the cathode.
B Chloride ions are reduced at the anode.
C Electrolysis of 47.5 g of molten magnesium chloride produces 12 dm^3 of chlorine.
D The process is endothermic.

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30 A student sets up the apparatus shown. The bulb does not light up.

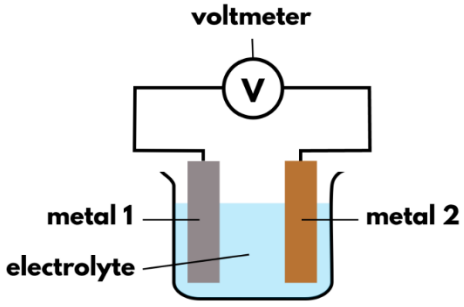


After the student adds substance X to the water, the bulb lights up. What is X?

A copper(II) carbonate
B carbon
C zinc sulfate
D ethanol

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31 Two metals and an electrolyte can be used in a simple cell to produce an electric current.
The table shows the voltage produced when two different metals are used.



metal 1	metal 2	voltage/ V
copper	zinc	1.10
copper	nickel	0.60
silver	zinc	1.56
silver	nickel	1.06
silver	iron	1.25

A student made some deductions based on the information given. Which one is correct?

A Nickel is more reactive than iron.
B The greater the difference in reactivity between the metals, the smaller the voltage produced.
C The voltage produced when **metal 1** and **2** are copper and iron would be about 0.80V.
D In a simple cell with copper and silver as the metals used, silver will be oxidised.

32 These statements refer to hydrogen and its use as a fuel. Which statements are correct?

1. Both water and hydrocarbons can be a source of hydrogen.
2. In a fuel cell, hydrogen reacts directly with oxygen to generate electricity.
3. The reaction taking place in a hydrogen fuel cell is a redox reaction.

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

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33 The formation of liquid water from hydrogen and oxygen may occur in three stages.

1 $2H_2(g) + O_2(g) \rightarrow 4H(g) + 2O(g)$
2 $4H(g) + 2O(g) \rightarrow 2H_2O(g)$
3 $2H_2O(g) \rightarrow 2H_2O(l)$

Which stage(s) is/are endothermic?

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

34 Which reactions involve oxidation and reduction?

1 chlorine gas reacting with aqueous potassium iodide
2 dilute sulfuric acid reacting with magnesium
3 dilute hydrochloric acid reacting with aqueous sodium hydroxide

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

35 Propane, C_3H_8, reacts with chlorine in the presence of ultra-violet light.
What are the possible products of this reaction?

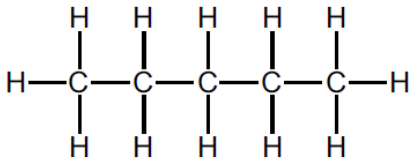
1 C_3H_7Cl
2 $C_3H_6Cl_2$
3 HCl
4 Cl_2

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

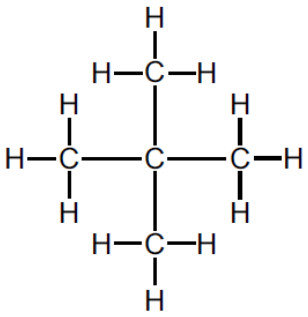
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36 The diagrams show the structures of five hydrocarbons.

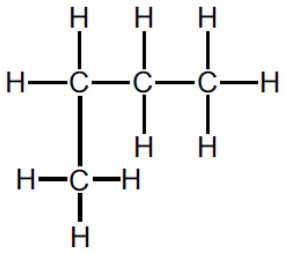
1



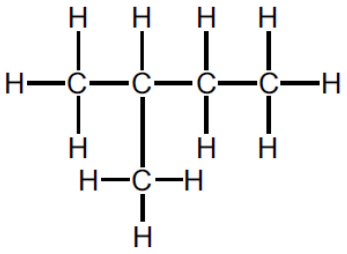
2



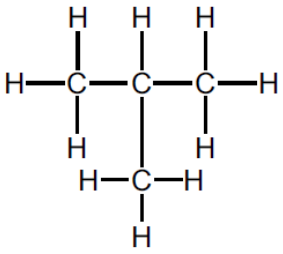
3



4



5



Which three hydrocarbons are isomers of each other?

A 1, 2 and 3
B 1, 2 and 4
C 2, 3 and 4
D 3, 4 and 5

37 Which statements about butanol are correct?

1 It is prepared by addition of hydrogen to butene.
2 It burns in excess oxygen to form carbon dioxide and steam.
3 It is oxidised by oxygen to form butanoic acid.
4 It is prepared from glucose by fermentation.

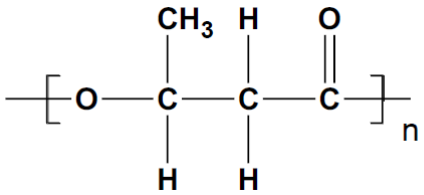
A 1 and 2 only
B 2 and 3 only
C 1 and 3 only
D 3 and 4 only

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38 An ester has the formula $C_2H_5COOC_3H_7$. What are the names of the alcohol and carboxylic acid used to make this ester?

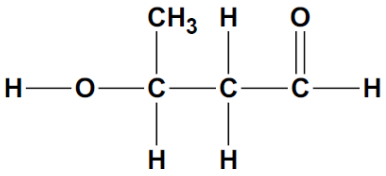
	Alcohol	Carboxylic Acid
A	ethanol	propanoic acid
B	propanol	ethanoic acid
C	propanol	propanoic acid
D	ethanoic acid	butanoic acid

39 Polyhydroxybutyric acid is a natural polymer produced by microorganisms as a form of energy storage. The structure of the polymer is as shown in the diagram.

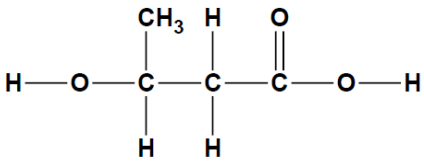


Which diagram represents a monomer of polyhydroxybutyric acid?

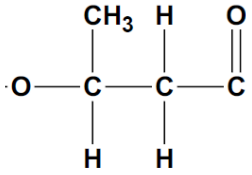
A



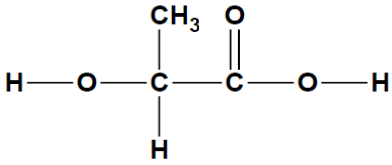
B



C



D



40 A steel factory and a chemical plant are built near a city. The limestone buildings in the city begin to crumble.
Which gas is most likely to have caused this damage?

A carbon dioxide
B carbon monoxide
C oxygen
D sulfur dioxide

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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 –	113 Nh nihonium –	114 Fl flerovium –	115 Mc moscovium –	116 Lv livermorium –	117 Ts tennessine –	118 Og oganesson –

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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