Name:		Index Number:		Class:	

CATHOLIC HIGH SCHOOL
Preliminary Examination
Secondary 4 (O-Level Programme)

CHEMISTRY 6092/01

Paper 1 Multiple Choice **29 August 2023**

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, pencil clips, glue or correction fluid.
Write your name, index number and class 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** and **D**.
Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

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 given on page **19**.
The use of an approved scientific calculator is expected, where appropriate.

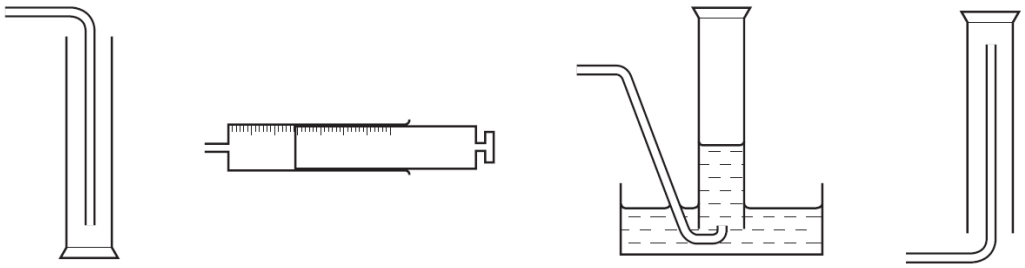
For examiner's use only:	**Total**	**/ 40**

This document consists of **19** printed pages.

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1 The diagrams show four different methods of collecting gases.



1 2 3 4

Which method is suitable for collecting a gas which has the properties described?

	method for collecting gas	properties of gas
A	1	less dense than air and soluble in water
B	2	denser than air and soluble in water
C	3	less dense than air and soluble in water
D	4	denser than air and insoluble in water

2 A mixture of three liquids is separated by fractional distillation in the school laboratory.

Which two statements are correct?

1 A pure sample of each liquid can be obtained after separation.

2 The mixture boils at constant temperature throughout the separation.

3 The three liquids are miscible with each other.

4 The three liquids are collected at the same time at different parts of the fractionating column.

A 1 and 3

B 1 and 4

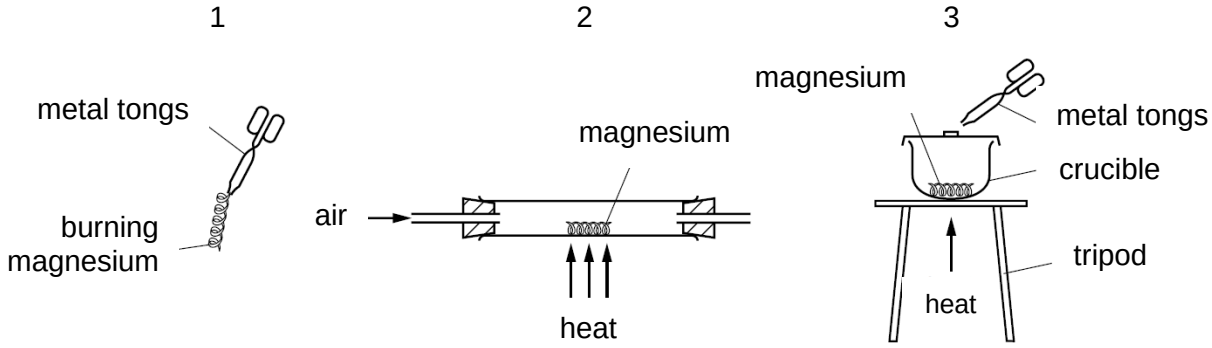
C 2 and 3

D 2 and 4

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3 When heated, magnesium reacts with oxygen in the air to form magnesium oxide, a white powder.

A student wants to investigate the percentage purity of a piece of magnesium ribbon. The student is given a balance and three sets of apparatus shown.



Which sets of apparatus are suitable for his investigation?

A 1, 2 and 3

B 1 and 3 only

C 2 and 3 only

D 2 only

4 Which substance should be pure for the intended use?

A a drug for curing diseases

B aluminium for making airplane bodies

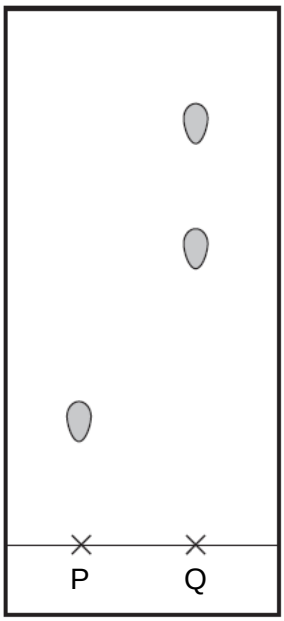
C petrol for car fuels

D tap water for human consumption

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5 P and Q are all samples of colourless alcohols.

A paper chromatogram is obtained for samples of P and Q.



Which row is correct?

	statement 1	statement 2
A	A locating agent was used.	P may be a pure substance.
B	A locating agent was used.	P must be a pure substance.
C	No locating agent was used.	Q contains a substance that is least soluble in the solvent used.
D	No locating agent was used.	Q contains a substance that is most soluble in the solvent used.

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6 Substance Y is added to an excess of hot water.

A blue solution forms and a brown solid remains.

The brown solid is filtered off and dried.

The brown solid conducts electricity.

Which statement about the substance Y, the blue solution, or the brown solid is **incorrect**?

A Substance Y may be a mixture which contains a metal.

B Substance Y may contain copper(II) carbonate.

C The blue solution must be an impure substance.

D The brown solid may be an impure substance.

7 P is a white powdery solid.

When a small spatula of P was added to a boiling tube filled with distilled water, P dissolved to form a blue solution.

The blue solution was divided into two separate test-tubes.

In the first test-tube, a blue precipitate was formed on dropwise addition of aqueous ammonia which dissolved in excess to form a deep-blue solution.

In the second test-tube, a white precipitate was formed on addition of an equal volume of acidified aqueous barium nitrate. The mixture was filtered and the filtrate crystallised to obtain solid Q.

What is P and Q?

	P	Q
A	barium sulfate	barium sulfate
B	barium sulfate	copper(II) nitrate
C	copper(II) sulfate	barium sulfate
D	copper(II) sulfate	copper(II) nitrate

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8 25.0 cm^3 of aqueous silver nitrate was added to 25.0 cm^3 of aqueous zinc nitrate to form mixture L.

Mixture L was then added to 150 cm^3 of 0.05 mol/dm^3 sodium iodide in a beaker.

1.18 g of precipitate was formed.

What is the concentration of silver nitrate present in mixture L?

A 0.065 mol/dm^3

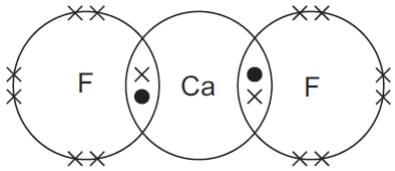
B 0.100 mol/dm^3

C 0.150 mol/dm^3

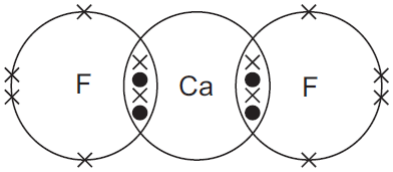
D 0.200 mol/dm^3

9 Which diagram shows the arrangement of the outermost electrons in calcium fluoride?

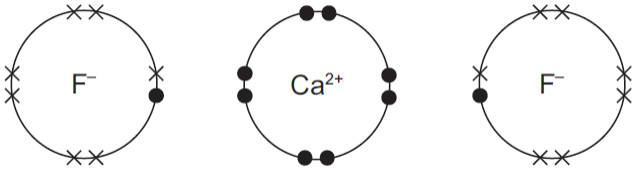
A



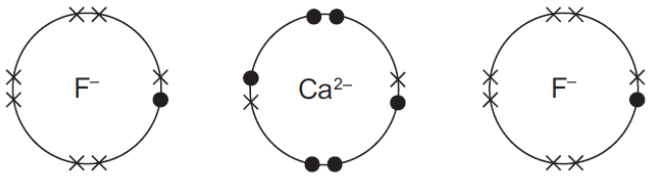
B



C

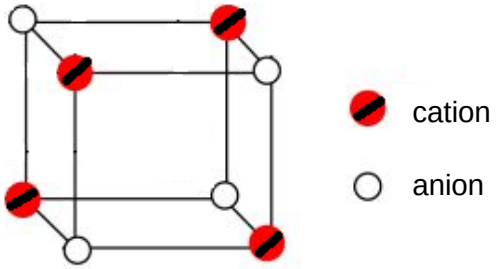


D



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10 Part of the giant lattice structure of an ionic compound is shown.



The structure repeats to make a giant lattice.

Which statement is **incorrect**?

A The ions are held by strong electrostatic forces of attraction.

B The lattice structure is broken down when this ionic compound dissolves in water.

C There are three anions directly surrounding each cation in the giant lattice.

D This lattice structure could resemble that of calcium oxide.

11 Which statement about the structure or bonding of metals is correct?

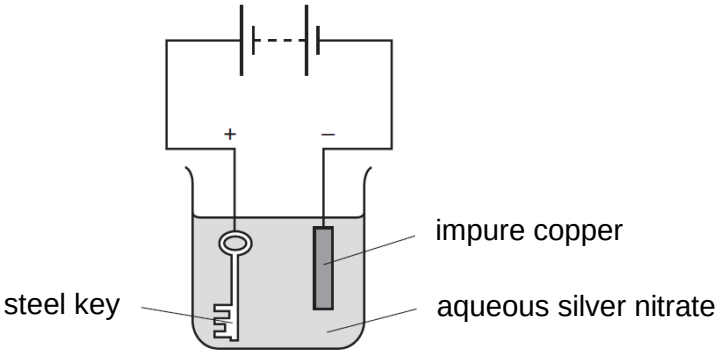
A A metal lattice consists of negative ions in a 'sea of electrons'.

B Electrons in a metal move randomly through the lattice.

C Metals are malleable because the ions present are mobile.

D The ions in a metal move when positive and negative electrodes are attached.

12 The apparatus shown is set up to plate a steel key with copper.



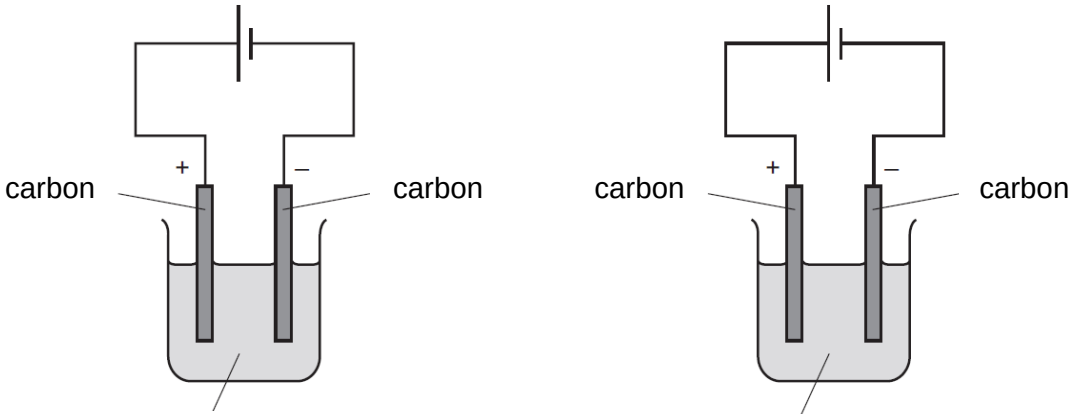
The steel key does not get plated with copper.

What is the **minimum** number of changes that needs to be made to plate the key with copper?

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

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13 The diagram shows the electrolysis of concentrated hydrochloric acid and concentrated aqueous sodium chloride using carbon electrodes.



Which is a similarity between the two electrolysis experiments?

A A gas which extinguishes a lighted splint with a 'pop' sound is produced at the negative electrode.

B A gas which relights a glowing splint is produced at the positive electrode.

C A gas which turns damp red litmus paper blue and then bleaches it is produced at the positive electrode.

D Electrons flow from the negative terminal of the battery towards the negative electrode, electrolyte, positive electrode and back to the positive terminal of the battery.

14 A simple cell can be made using two different metals as the electrodes and an aqueous solution as the electrolyte.

Which statements about simple cells are correct?

1 A greater voltage is produced using magnesium and silver than using magnesium and copper.

2 Ethanol can be used as the electrolyte.

3 The more reactive metal will release electrons.

4 An anion always gets discharged at the negative electrode.

A 2 only

B 1 and 3 only

C 1, 3 and 4 only

D 1, 2, 3 and 4

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15 The reaction between hydrogen and iodine to form hydrogen iodide is exothermic.

Which statement explains why the reaction is exothermic?

A More bonds are formed than broken.

B The activation energy is less than the energy released when bonds are formed.

C The bond energies of the reactants are greater than the bond energies of the products.

D The products are at a higher energy level than the reactants.

16 Lumps of copper(II) carbonate was added to 100 cm^3 of 1.00 mol/dm^3 dilute sulfuric acid which is in excess.

$$CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + H_2O + CO_2$$

The rate of the reaction and total volume of gas produced can be changed by varying the conditions.

Which changes always increase **both** the rate of the reaction and the total volume of gas produced?

1 adding more powdered copper(II) carbonate

2 increasing the concentration of sulfuric acid

3 increasing the temperature

4 increasing the volume of sulfuric acid

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

17 Aqueous iron(III) chloride reacts with aqueous potassium iodide.

$$v FeCl_3 + w KI \rightarrow x FeCl_2 + y KCl + I_2$$

Which statements are correct?

1 In the balanced equation, *v*, *w*, *x* and *y* have the same value.

2 A purplish-black vapour is produced in the reaction.

3 Potassium iodide is used to test for the presence of an oxidising agent.

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

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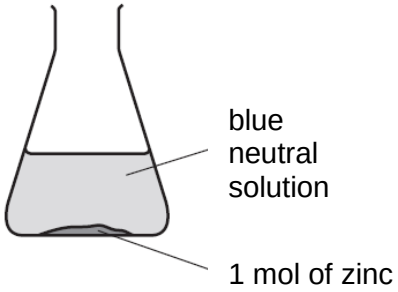
18 In an experiment, 1 mole of powdered copper and 1 mole of powdered zinc are placed in a flask.

1 mole of a dilute monobasic acid is added to the flask.

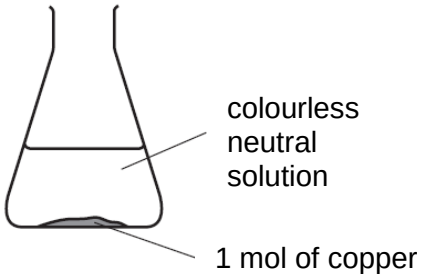
The flask is left to stand until all reactions, if any, are complete.

Which diagram shows the result of the experiment?

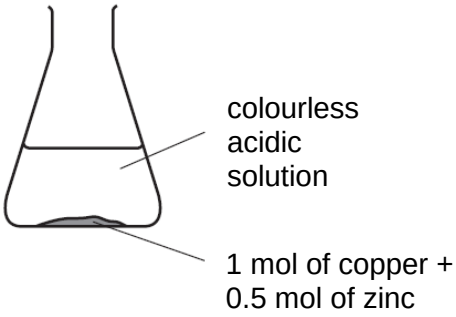
A



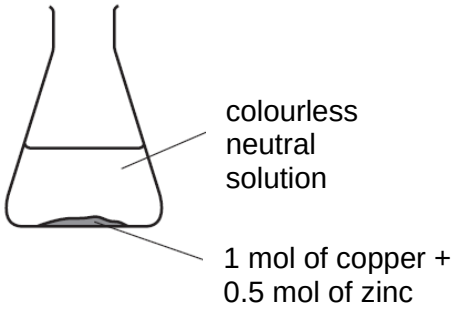
B



C



D



19 Which statements about sulfuric acid are correct?

1 Sulfuric acid can be used to treat excess acidity in soil.

2 Sulfuric acid is used as a battery acid.

3 Sulfuric acid is used in the manufacture of detergents.

4 The reaction between dilute sulfuric acid and any soluble base can be represented by the equation $H^+(aq) + OH^-(aq) \rightarrow H_2O(l)$.

A 4 only

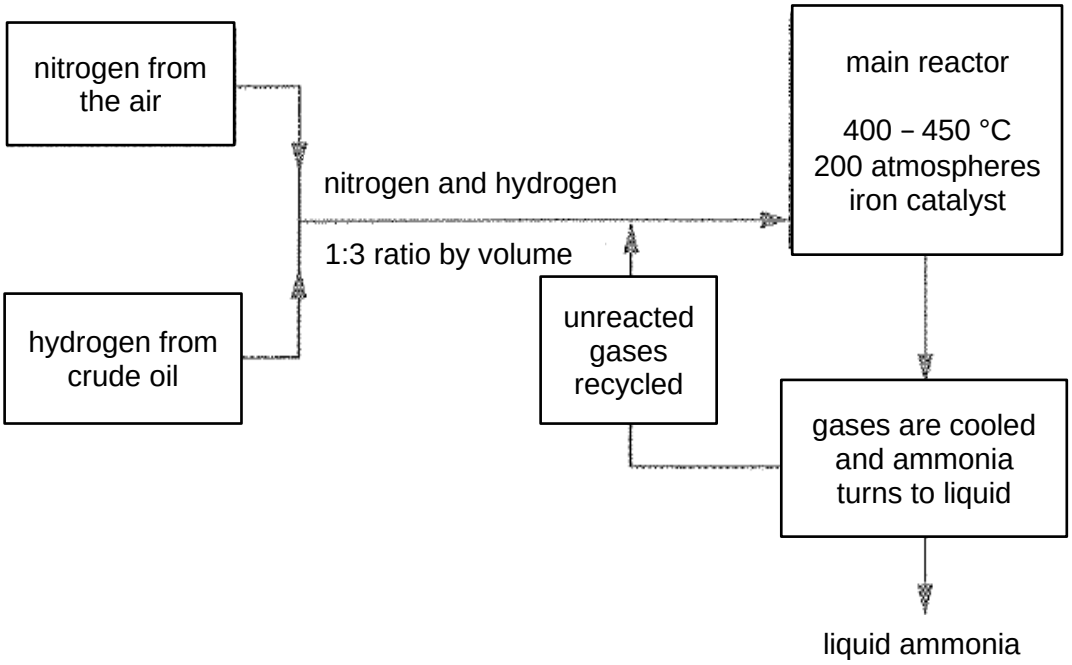
B 1 and 2 only

C 2 and 4 only

D 2, 3 and 4 only

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20 The Haber process for making ammonia can be represented using a flow diagram.



Which change in conditions would produce a greater **final** amount of ammonia made from a fixed amount of nitrogen and hydrogen?

	adding a catalyst	increasing the pressure
A	✓	✓
B	✓	×
C	×	✓
D	×	×

key

✓ = produce a greater final amount of ammonia

× = does not produce a greater final amount of ammonia

21 Which compound when warmed with aqueous calcium hydroxide would give the largest mass of ammonia gas?

A 0.5 mol of $(NH_4)_3PO_4$

B 1.0 mol of $Al(NO_3)_3$

C 1.0 mol of NH_4Cl

D 1.0 mol of $(NH_4)_2SO_4$

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22 A student wrote down part of the method used to make lead(II) chloride.

1 Add excess dilute nitric acid to lead(II) carbonate.

2 Add excess dilute hydrochloric acid to the filtrate.

3 Filter the mixture.

What is the purpose of each of the underlined words in steps 1, 2 and 3?

	step 1	step 2	step 3
A	to ensure all the lead(II) carbonate has reacted	to ensure maximum yield of lead(II) chloride	to obtain the residue
B	to ensure all the lead(II) carbonate has reacted	to speed up reaction	to obtain the filtrate
C	to remove carbonate ions	to ensure maximum yield of lead(II) chloride	to obtain the residue
D	to remove carbonate ions	to speed up reaction	to obtain the residue

23 Excess barium oxide and barium carbonate are added separately to dilute hydrochloric acid.

Which row correctly shows whether a pure sample of barium chloride can be obtained from the resultant mixture?

You may assume that barium oxide is soluble in water.

	barium oxide	barium carbonate
A	✓	✓
B	✓	×
C	×	✓
D	×	×

key
✓ = can obtain pure barium chloride
× = cannot obtain pure barium chloride

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24 Which statement about the elements in the Periodic Table is correct?

A Atoms of elements lose electrons less easily down a group of the Periodic Table.

B Elements are arranged in the order of increasing relative atomic masses.

C Elements in the same group of the Periodic Table have the same number of completely filled electron shells.

D The metallic character of the elements decreases from left to right across a period of the Periodic Table.

25 Which statement about the properties of the elements in Group 0 of the Periodic Table, helium to xenon, is correct?

A Argon reacts with iron to form a compound.

B Helium is less dense than air.

C The elements change from gas to solid down the group.

D The elements exist as covalent molecules.

26 Which property is common to ^{40}Ca, ^{39}K and ^{23}Na?

A Their atoms all have more neutrons than protons.

B Their ions all have eight electrons in their outer shell.

C They all sink when added to water.

D They are all deposited at the positive electrode when their molten chloride is electrolysed.

27 Which statement is true for all metals?

A They form alloys with other elements through chemical means.

B They form either amphoteric or basic oxides.

C They have a high density.

D They have a high melting point.

28 Which pair of substances, when added together, would result in heat being evolved?

A Ag(s) and $Cu(NO_3)_2$ (aq)

B Cu(s) and $Mg(NO_3)_2$ (aq)

C Mg(s) and $Ca(NO_3)_2$(aq)

D Zn(s) and $Cu(NO_3)_2$ (aq)

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29 Scrap iron is often recycled.

Which reason for recycling is **incorrect**?

A It reduces the amount of carbon dioxide formed at the site of the ore extraction.

B It reduces the amount of waste taken to landfill sites.

C It reduces the need to collect scrap iron.

D It saves finite resources.

30 Mild steel is galvanised to prevent corrosion of the iron.

Which statements about galvanising are correct?

1 Galvanising makes a steel alloy.

2 Galvanising provides a sacrificial protection against rusting.

3 Galvanising coats a layer of zinc onto steel.

A 1 and 2 only

B 1 and 3 only

C 2 and 3 only

D 1, 2 and 3

31 A student wrote four statements about some of the gases that can be found in polluted or unpolluted air.

- Carbon dioxide is absent in unpolluted air.
- Dry air contains about 78% of oxygen.
- Sulfur dioxide is released by volcanoes.
- The noble gases make up about 5% of dry air.

How many statements are correct?

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

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32 Which row gives the correct problems associated with the gaseous pollutant in the atmosphere?

	pollutant	problems
A	carbon monoxide	causes shortness of breath and hence death in humans
B	chlorofluorocarbons	more ultraviolet radiation reaches the Earth hence worsening global warming
C	nitrogen monoxide	acid rain
D	sulfur dioxide	irritates respiratory tract, causing bronchitis

33 Petroleum is separated into fractions by fractional distillation.

Some properties of three of these fractions are shown.

fraction	boiling point range / °C	number of carbon atoms in the molecules
1	?	5 − 10
2	320 − 350	16 − 24
3	120 − 210	?

Which statement is correct?

A Fraction 1 has a higher boiling point than fraction 2.

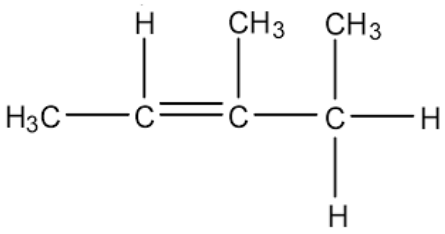
B Fraction 2 is removed from higher up the fractionating column than fraction 1.

C Molecules in fraction 3 have shorter chains than those in fraction 2.

D Fraction 2 is used as a fuel in cars.

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34 The structure of alkene J is shown.



Four statements are made about alkene J.

1 Addition of hydrogen to J gives the alkane $(CH_3)_2CHCH(CH_3)_2$.

2 J can be manufactured by cracking.

3 J does not burn in air to form carbon dioxide and water.

4 The number of C–C single bonds is increased by reacting J with bromine.

Which statements are correct?

A 1 and 3 only

B 1 and 4 only

C 2 and 3 only

D 2 and 4 only

35 Which alkene, on addition of steam, can produce only **one** alcohol?

A $CH_3CH=CH_2$

B $CH_3CH_2CH=CH_2$

C $(CH_3)_2C=CHCH_3$

D $(CH_3)_2C=C(CH_3)_2$

36 Ethanol is made industrially by the fermentation of glucose or by the catalytic addition of steam to ethene.

Which statement describes an advantage of fermentation compared to catalytic addition?

A Fermentation does not contribute to global warming.

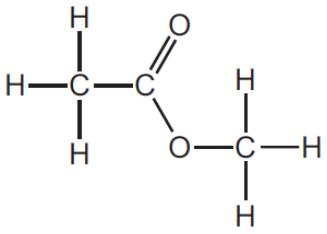
B Fermentation produces a higher yield of ethanol.

C Fermentation produces pure ethanol.

D Fermentation uses a renewable resource.

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37 The structure of ester W is shown.



Which statement about ester W is **incorrect**?

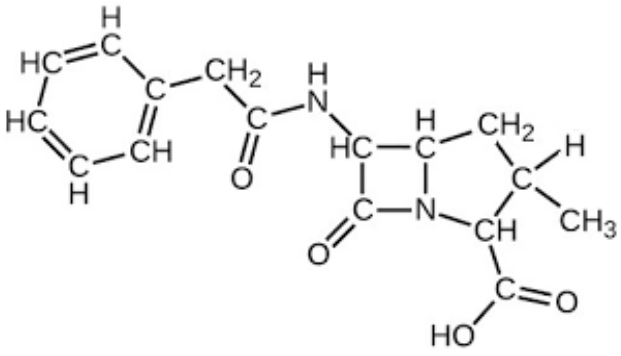
A Ester W can be used to make solvents.

B Ester W is formed by a condensation reaction.

C One mole of methanol reacts with one mole of ethanoic acid to give one mole of ester W and one mole of water.

D Propanoic acid is an isomer of ester W.

38 The structure of an organic compound is shown.



Which statement about this organic compound is correct?

A It gives off a sweet-smelling substance when reacted with a carboxylic acid.

B It is a hydrocarbon.

C It is polyunsaturated.

D Its empirical formula is $C_8H_8O_2N$.

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39 Hexane and hexene are organic compounds with the molecular formulae, C_6H_{14} and C_6H_{12} respectively.

Some properties of colourless liquid L and M are listed.

liquid L	liquid M
• When added to water, two layers form which do not mix. • It does not react with sodium hydroxide. • It boils at 65 °C.	• When added to water, two layers form which do not mix. • It does not react with sodium hydroxide. • It decolourises bromine water.

What could liquid L and M be?

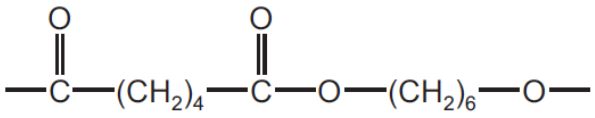
	liquid L	liquid M
A	ethanol	hexene
B	ethanol	ethane
C	hexane	ethene
D	hexene	hexene

40 P is a polymer that:

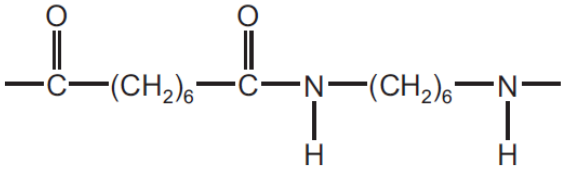
- has six carbon atoms in each of the monomers from which it is formed
- is not a polyester
- is non-biodegradable and suitable to use in parachutes and sleeping bags

What is the partial structure of P?

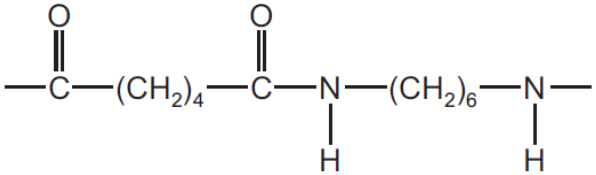
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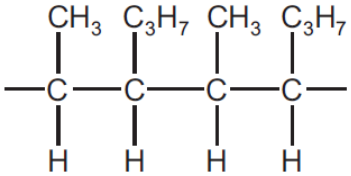
B



C



D



−End−

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The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	0
							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											13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium -	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57 – 71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium –	85 At astatine –	86 Rn radon –
87 Fr francium –	88 Ra radium –	89 – 103 actinoids	104 Rf Rutherfordium –	105 Db dubnium –	106 Sg seaborgium –	107 Bh bohrium –	108 Hs hassium –	109 Mt meitnerium –	110 Ds darmstadtium –	111 Rg roentgenium –	112 Cn copernicium –		114 Fl flerovium –		116 Lv livermorium –		

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

The volume of one mole of any gas is 24 dm^3 at room temperature and pressure (r.t.p.).

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