GUANGYANG SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2022
Secondary Four Express

CANDIDATE NAME	

CENTRE NUMBER					INDEX NUMBER					CLASS/ REG No.	/

CHEMISTRY
Paper 1 Multiple Choice

6092/01
31 August 2022
1 hour

Additional Materials: Multiple Choice Answer Sheet
Periodic Table

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, highlighters, glue or correction fluid.
Write your name, centre number, index number, class and register number in the spaces above.

There are **forty** questions on this paper. Answer all questions.
For each question there are four possible answers, **A, B, C** and **D**.

Read the instructions on the Answer Sheet 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.

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

This question paper consists of 16 printed pages, inclusive of this cover page

Y

PAPER 1 (40 MARKS)

This paper consists of 40 multiple-choice questions. For each question, there are four possible answers. Choose the best answer you consider correct and record your answer on the Answer Sheet provided.

1 Copper (II) nitrate is soluble in water. Copper (II) carbonate is insoluble in water.
A mixture of solid copper (II) nitrate and copper(II) carbonate is added to a beaker of water.
It is stirred until no more solid dissolves.
How can separate samples of copper (II) nitrate and copper (II) carbonate be obtained from the resulting mixture?

A crystallisation followed by distillation
B evaporation followed by distillation
C evaporation followed by filtration
D filtration followed by crystallisation

2 A mixture of three liquids is separated by fractional distillation.
Which statements are **correct**?

1 The mixture boils at constant temperature throughout the separation.
2 The temperature at which the mixture boils increases during the separation.
3 The liquid with the highest boiling point is collected first.
4 The liquid with the lowest boiling point is collected first.

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

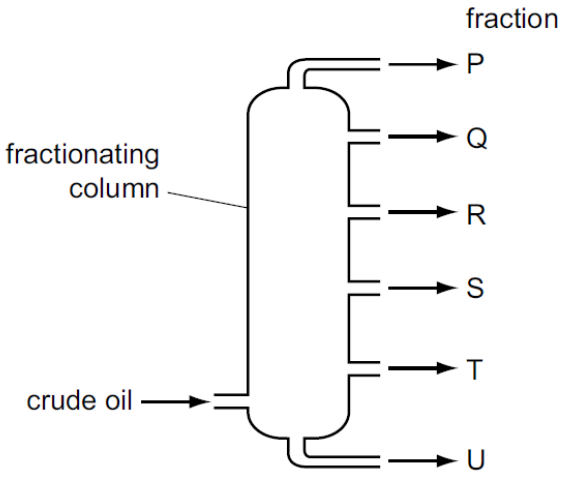
3 It is possible to produce Ar^{2+} ions from argon atoms in a laboratory.
Which statement is **correct**?

A Each argon atom gains two electrons and loses the electronic configuration of an inert gas.
B Each argon atom gains two electrons and obtains the electronic configuration of an inert gas.
C Each argon atom loses two electrons and loses the electronic configuration of an inert gas.
D Each argon atom loses two electrons and obtains the electronic configuration of an inert gas.

4 Two isotopes of chlorine are ^{35}Cl and ^{37}Cl.
Using these isotopes, how many different relative molecular masses are possible for the compound with molecular formula $C_2H_3Cl_3$?

A 2
B 3
C 4
D 5

5 The diagram below shows a fractionating column used in the separation of petroleum.



Which row explains why fraction R is collected above fraction S?

	boiling point of R	average molecular mass of R
A	greater than S	greater than S
B	greater than S	smaller than S
C	smaller than S	greater than S
D	smaller than S	smaller than S

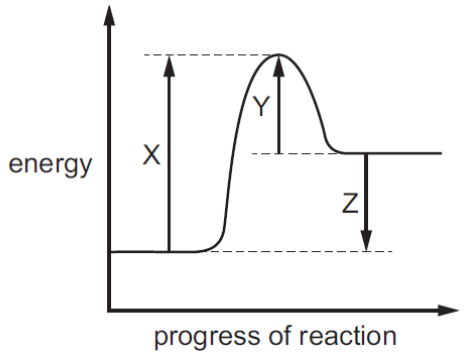
6 The table shows data for some particles. There are gaps represented by W, X, Y and Z.

particle	proton number	nucleon number	number of neutrons	number of electrons
Ar	18	40	W	18
K^+	19	39	20	X
Sc	21	Y	24	21
S^{2-}	16	32	16	Z

Which row shows the correct values for W, X, Y and Z?

	W	X	Y	Z
A	20	20	42	14
B	20	20	42	16
C	22	18	45	14
D	22	18	45	18

7 The energy profile diagram of a chemical reaction is shown below.



Which statement is **correct**?

A The reaction is exothermic.
B Y represents ΔH for the reaction.
C X represents the activation energy for the reaction.
D Z represents the energy given out as the reaction proceeds.

8 Three statements about the elements carbon, nitrogen and sulfur are shown below.

1 They are in groups next to each other in the Periodic Table.
2 Their neutron to proton ratios are all two to one.
3 They each form an acidic oxide.

Which statements are **correct**?

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

9 When K_2MnO_4 is dissolved in water, the following reaction occurs.

$$a MnO_4^{2-}(aq) + b H_2O(l) \rightarrow c MnO_4^{-}(aq) + d\ MnO_2(s) + e OH^{-}(aq)$$

What could be the values of *a* and *c* in the balanced chemical equation?

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

10 Many elements and compounds contain covalent bonds.
Which statement about covalently bonded elements and compounds is **correct**?

A Aqueous solutions of covalent compounds always conduct electricity.
B Bonding in the nitrogen molecule involves three shared pairs of electrons.
C Double covalent bonds are present in ethene and in water.
D The formation of covalent bonds always produces atoms with eight electrons in their outer shells.

11 J is an aqueous solution.
On addition of aqueous sodium hydroxide to J a green precipitate is formed.
The resulting mixture is heated and no gas is formed.
Aluminium foil is added to the warmed mixture. A gas is formed that turns damp red litmus paper blue.
Which ions could be present in J?

A Fe^{3+} and NH_4^+
B Fe^{3+} and NO_3^-
C Fe^{2+} and NH_4^+
D Fe^{2+} and NO_3^-

12 An aqueous solution of zinc chloride is tested by adding reagents.
Which observation is **correct**?

	reagent added to zinc chloride (aq)	observations
A	acidified aqueous barium nitrate	forms a white precipitate
B	aqueous ammonia	forms a white precipitate, soluble in excess of the reagent
C	aqueous sodium hydroxide	forms a white precipitate, insoluble in excess of the reagent
D	powdered copper	forms a grey precipitate

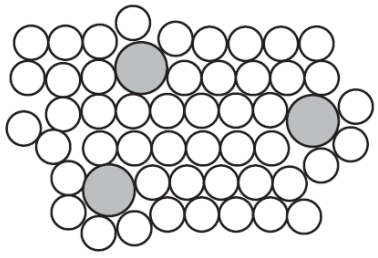
13 Which reaction is a redox reaction?

A $Mg + 2HCl \rightarrow MgCl_2 + H_2$
B $MgCO_3 + 2HCl \rightarrow MgCl_2 + H_2O + CO_2$
C $MgO + 2HCl \rightarrow MgCl_2 + H_2O$
D $Mg(OH)_2 + 2HCl \rightarrow MgCl_2 + 2H_2O$

14 One mole of an organic compound, **Q**, is completely burnt in oxygen and produces exactly three moles of water. Which compound is **Q**?

A butane, C_4H_{10}
B ethanol, C_2H_5OH
C propane, C_3H_8
D propanol, C_3H_7OH

15 The diagram below shows the structure of an alloy.



Which statement about alloys is **correct**?

A The alloy brass has a chemical formula.
B High carbon steel alloys are soft and easily shaped.
C Alloys can only be formed by mixing copper or iron with other metals.
D In an alloy there is attraction between positive ions and a 'sea of electrons'.

16 Calcium carbonate, $CaCO_3$, reacts with an acid, HA as shown below.

$$CaCO_3(s) + 2HA(aq) \rightarrow CaA_2(aq) + H_2O(l) + CO_2(g)$$

What is the minimum mass of acid required to react completely with 10 g of calcium carbonate?
[M_r: HA, 46; $CaCO_3$, 100]

A 4.6 g
B 9.2 g
C 10 g
D 20 g

17 When concentrated sulfuric acid reacts with sodium iodide the products include sulfur, iodine, hydrogen sulfide and sulfur dioxide.
Which statement is **correct**?

A Hydrogen sulfide is the product of a reduction reaction.
B Iodide ions are stronger oxidising agents than sulfate ions.
C Sulfur atoms from the sulfuric acid are both oxidised and reduced.
D Sulfur atoms from the sulfuric acid are oxidised to make sulfur dioxide.

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

19 The names and formulae of three nitrogen compounds are shown below.

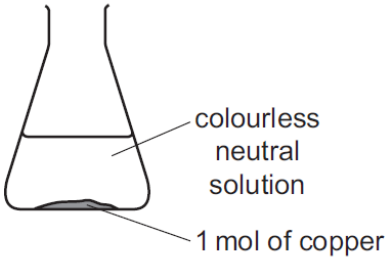
ammonia	hydrazine	hydroxylamine
NH_3	N_2H_4	NH_2OH

Which compound has the highest relative molecular mass, M_r, and in which compound is the percentage by mass of hydrogen the **greatest**?

	highest M_r	greatest percentage by mass of hydrogen
A	N_2H_4	NH_3
B	N_2H_4	N_2H_4
C	NH_2OH	NH_3
D	NH_2OH	N_2H_4

20 In an experiment, 1 mol of powdered copper and 1 mol of powdered zinc are placed in a flask.
Dilute acid, containing 1 mol of acid, is added to the flask.
The flask is left until all the reactions, if any, are complete.
Which diagram shows the result of the experiment?

A



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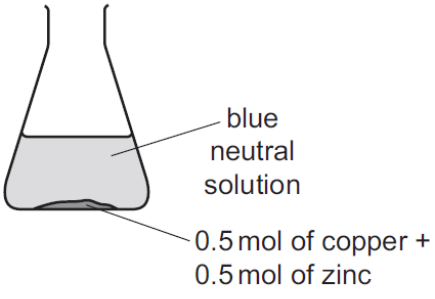

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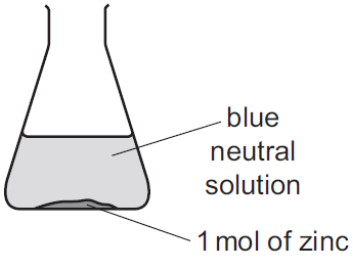

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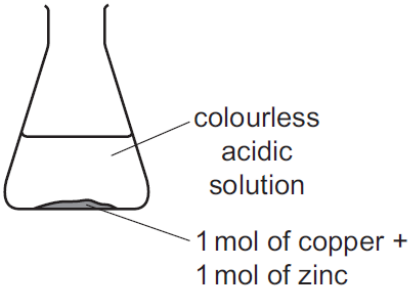


21 The diagram below shows the positions of elements L, M, Q, R and T in the Periodic Table. These letters are not the chemical symbols of the elements.

Which statement about the properties of these elements is **correc**t?

A L reacts more vigorously with water than does M.
B L, M and Q are all metals.
C T exists as diatomic molecules.
D T is more reactive than R.

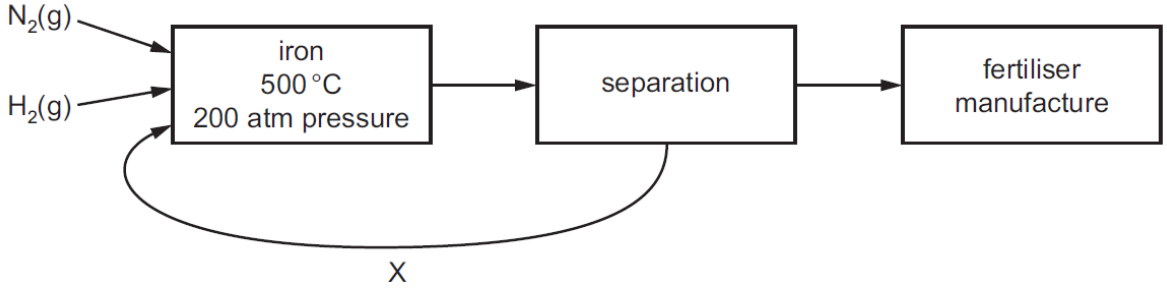
22 The section of the reactivity series shown includes a newly discovered metal, symbol X.

Ca
Mg
Fe
X
H
Cu

The only oxide of X has the formula XO. Which equation shows a reaction which occurs?

A $Cu\ (s) + X^{2+}\ (aq) \rightarrow Cu^{2+}\ (aq) + X\ (s)$
B $2X\ (s) + Cu^{2+}\ (aq) \rightarrow 2X^{+}\ (aq) + Cu\ (s)$
C $X\ (s) + Fe_2O_3\ (s) \rightarrow 2Fe\ (s) + 3XO\ (s)$
D $X\ (s) + 2HCl\ (aq) \rightarrow XCl_2\ (aq) + H_2\ (g)$

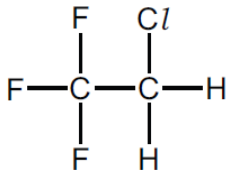
23 The diagram below shows the main stages in the manufacture of an ammonia-based fertiliser.



What is happening in the process labelled X?

A Unreacted hydrogen only is recycled.
B Unreacted hydrogen and nitrogen are recycled.
C The gases are cooled to cause ammonia to form a liquid.
D Ammonia is returned to the start of the process to shift the equilibrium towards the product.

24 CFC compounds were used as aerosol propellants. The structure of one CFC compound is shown.



Which element in this compound causes a depletion of ozone in the atmosphere?

A carbon
B chlorine
C fluorine
D hydrogen

25 Pollutant gases are released by the bacterial decay of vegetable matter.
The bacterial decay of vegetable matter is the main source of which gas?

A carbon monoxide
B methane
C nitrogen dioxide
D sulfur dioxide

26 The rate of a chemical reaction decreases as the temperature decreases because at a lower temperature:

1 a lower proportion of molecules have energy that exceeds the activation energy
2 the molecules are further apart
3 the frequency of successful collision is less.

Which reasons **correctly** explain this decrease?

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

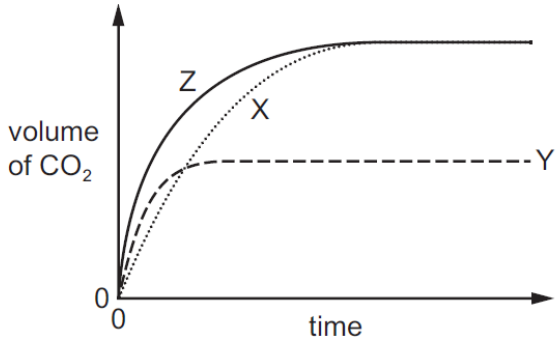
27 If a sample of ammonia is passed over heated iron, two gases, X and Y, are formed.
Gas X reacts with oxygen. Gas Y is unreactive.
Which statement is **correct**?

A Gas X reacts with oxygen to form water.
B Gas Y is a compound.
C The formation of the two gases from ammonia cannot be reversed.
D There is a triple covalent bond in one molecule of gas X.

28 The rate of the reaction between a metal carbonate and a dilute acid is followed by measuring the volume of carbon dioxide produced and plotting this against time.

The line labelled X shows the results of an experiment using 50 cm^3 of 1.0 mol / dm^3 hydrochloric acid and excess metal carbonate.

The experiment is repeated using different conditions and lines Y and Z are drawn to show the volumes of carbon dioxide produced against time.



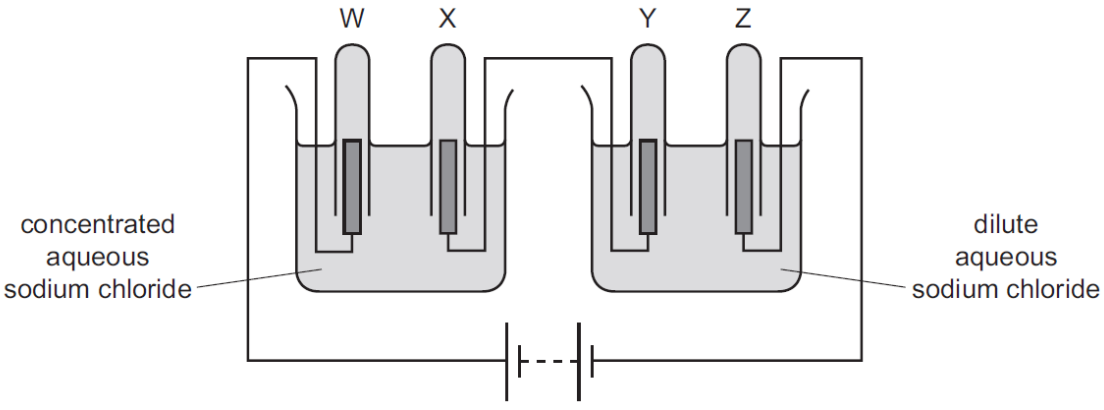
Which row shows the conditions that could give lines Y and Z?

	conditions for Y	conditions for Z
A	50 cm^3 of 0.5 mol / dm^3 hydrochloric acid at same temperature.	25 cm^3 of 2.0 mol / dm^3 hydrochloric acid at same temperature
B	50 cm^3 of 0.5 mol / dm^3 hydrochloric acid at same temperature with a catalyst.	12.5 cm^3 of 4.0 mol / dm^3 hydrochloric acid at same temperature.
C	50 cm^3 of 1.0 mol / dm^3 hydrochloric acid at a lower temperature.	50 cm^3 of 1.0 mol / dm^3 hydrochloric acid at a higher temperature.
D	50 cm^3 of 0.5 mol / dm^3 hydrochloric acid at a higher temperature.	50 cm^3 of 1.0 mol / dm^3 sulfuric acid at same temperature.

29 Magnesium can be produced by electrolysis of molten magnesium chloride, $MgCl_2$.
What are the equations for the reactions that occur at the positive electrode and at the negative electrode?

	positive electrode	negative electrode
A	$2Cl^- \rightarrow Cl_2 + 2e^-$	$2H^+ + 2e^- \rightarrow H_2$
B	$Cl_2 + 2e^- \rightarrow 2Cl^-$	$Mg^{2+} + 2e^- \rightarrow Mg$
C	$2Cl^- \rightarrow Cl_2 + 2e^-$	$Mg^{2+} + 2e^- \rightarrow Mg$
D	$2Cl^- \rightarrow Cl_2 + 2e^-$	$Mg^{2+} + 2e^- \rightarrow 2Mg$

30 The diagram below shows the electrolysis of concentrated and dilute aqueous sodium chloride using inert electrodes. Gases are produced and collected in each of the test-tubes W, X, Y and Z.

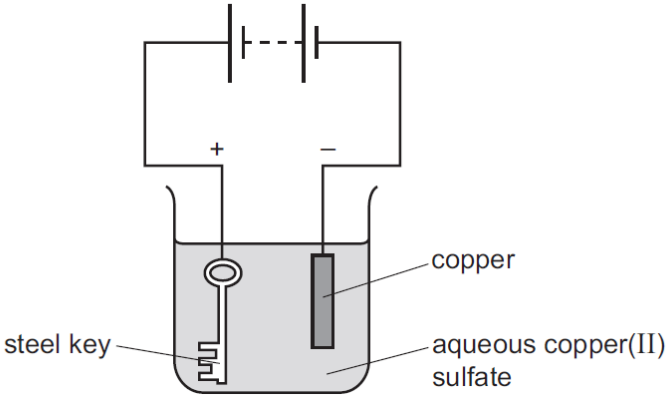


Which statements are **correct**?

1 Approximately equal volumes of gas are produced and collected in test-tubes W and X.
2 Approximately equal volumes of gas are produced and collected in test-tubes Y and Z.
3 Three different gases are produced in the experiment.

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

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



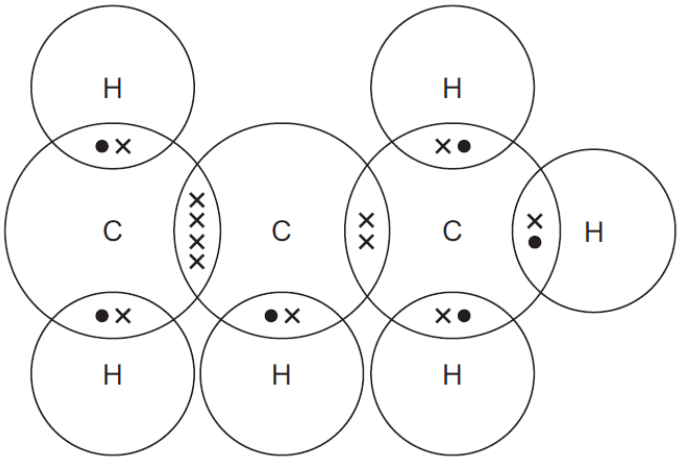
The key does not get coated with copper.
Which change needs to be made to plate the key?

A Increase the voltage.
B Reverse the electrical connections.
C Replace the solution with dilute sulfuric acid.
D Increase the concentration of the aqueous copper (II) sulfate.

32 A hydrocarbon, C_xH_y, undergoes an addition reaction with chlorine.
A second hydrocarbon, C_pH_q, undergoes a substitution reaction with chlorine.
If x = 4 and p = 6, what are the values of y and q?

	y	q
A	8	16
B	8	14
C	10	12
D	10	14

33 Compound X is shown in the dot-and-cross diagram below.



Which statement about compound X is **correct**?

A It is a saturated hydrocarbon.
B It is an isomer of butene.
C It will decolourise bromine water.
D Its chemical name is propane.

34 A solution of sodium hydroxide reacts with 3 mol of chlorine under certain conditions. The reaction produces 5 mol of sodium chloride and 1 mol of X, the only other chlorine-containing product.
What is the formula of compound X?

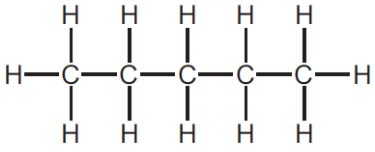
A NaC*l*O
B NaC*l*O_2
C NaC*l*O_3
D NaC*l*O_4

35 An ester is formed from a carboxylic acid and an alcohol.
How does the number of carbon, hydrogen and oxygen atoms in an ester differ from the total number of these atoms in the carboxylic acid and alcohol from which the ester is formed?

	carbon atoms	hydrogen atoms	oxygen atoms
A	fewer	fewer	fewer
B	fewer	same	fewer
C	same	fewer	fewer
D	same	same	same

36 The diagrams below show the structures of five hydrocarbons.

1



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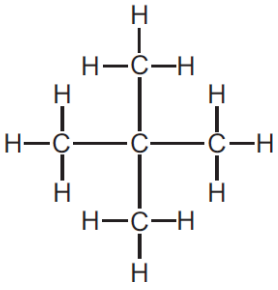

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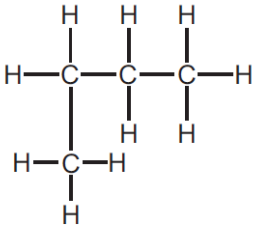

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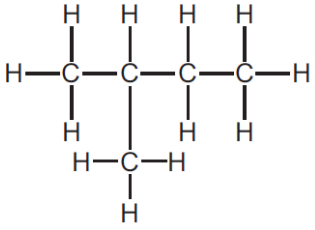

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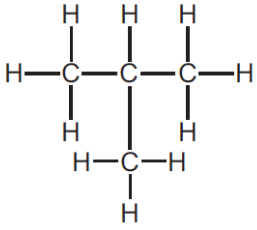


Which three hydrocarbons are isomers of each other?

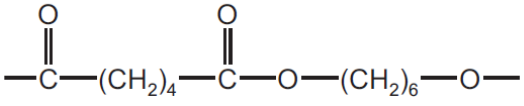
A 1, 2 and 4
B 2, 3 and 5
C 2, 3 and 4
D 3, 4 and 5

37 P is a polymer that:

- has six carbon atoms in each of the monomers from which it is formed
- is **not** a polyester
- is formed using condensation polymerisation.

What is the partial structure of P?

A



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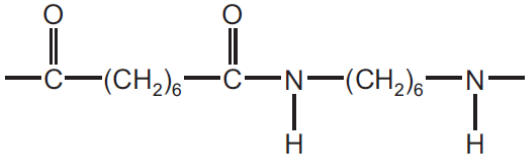

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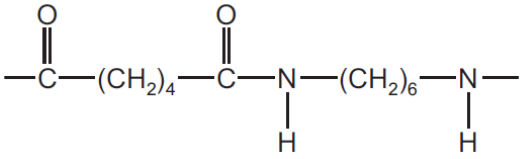

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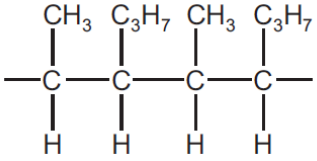
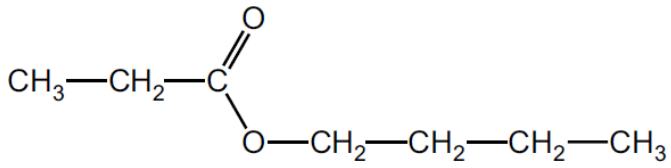


38 A carboxylic acid with molecular formula $C_4H_8O_2$ reacts with an alcohol with molecular formula
C_3H_8O to form an ester. What is the formula of the ester formed?

A



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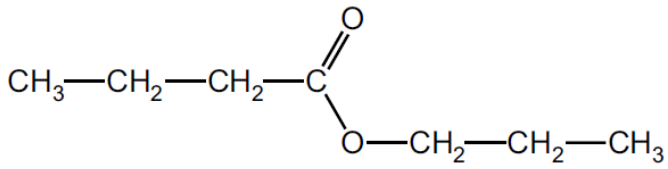

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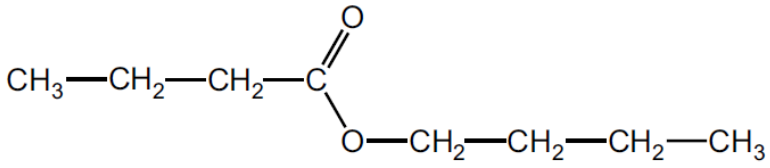

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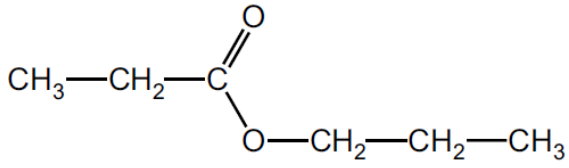
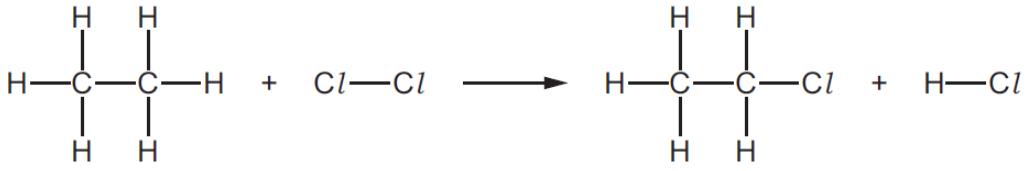


39 Chlorine reacts with ethane to produce chloroethane and hydrogen chloride.
The reaction is exothermic.



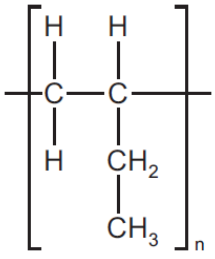
The bond energies are shown in the table.

bond	bond energy in kJ / mol
C–C*l*	+340
C–C	+350
C–H	+410
C*l*–C*l*	+240
H–C*l*	+430

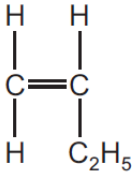
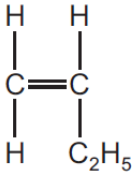
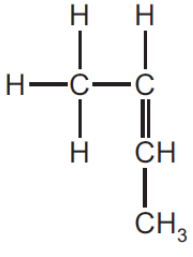
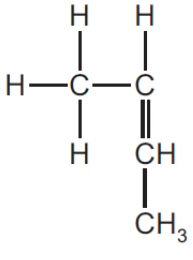
What is the energy change for the reaction?

A –1420 kJ / mol
B –120 kJ / mol
C +120 kJ / mol
D +1420 kJ / mol

40 The diagram below shows the repeat unit of a polymer.



Which row **correctly** identifies the monomer and type of polymerisation involved in making this polymer?

	monomer	type of polymerisation
A		addition
B		condensation
C		addition
D		condensation

End of Paper

Setter: Ms Kim