VICTORIA JUNIOR COLLEGE
JC 2 PRELIMINARY EXAMINATION
Higher 1

CHEMISTRY ANSWER **8873/01**

Paper 1 Multiple Choice **19 September 2025**

1 hour

Additional Materials: Multiple Choice Answer Sheet
Data Booklet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name and CT group on the Answer Sheet.

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

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

This document consists of **10** printed pages.

For each question there are four possible answers, **A**, **B**, **C**, and **D**. Choose the **one** you consider to be correct.

1 ^{9}Be is used in the production of 'fast neutrons'.

How many neutrons are present in 0.09 g of ^{9}Be?
[*L* = Avogadro constant]

A 0.04 *L* **B** 0.05 *L* **C** 0.09 *L* **D** 0.45 *L*

Answer: B

Amount of ^{9}Be = 0.09 / 9 = 0.01 mol
No. of ^{9}Be atoms = 0.01 x L = 0.01 L
Mole ratio of ^{9}Be : neutrons
1 : (9–4) = 5

No. of neutrons = 0.01 L x 5 = 0.05 L

2 The table below shows the fifth, sixth, seventh, eighth and ninth ionisation energies of elements **L** and **M** in kJ mol^{-1}. Elements **L** and **M** are found in period 3.

	5th	6th	7th	8th	9th
L	6270	21300	25400	29900	35900
M	6540	9360	11000	33600	38600

Given that all the atoms have at least an octet configuration, what could <u>not</u> be the formula of the compound formed by these two elements?

A LM_5

B LM_4^+

C LM_3

D LM_2

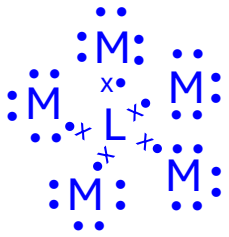
Answer: D

For element L, there is a large increase from the 5th to the 6th ionisation energy, indicating that the 6th electron is removed from the next inner quantum shell. This means that the element has 5 valence electrons and is in group 15. The element is Phosphorous.

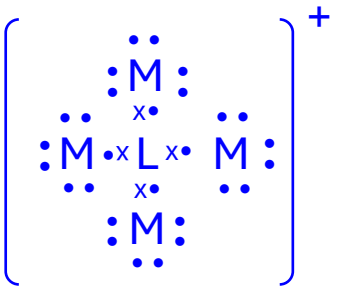
For element M, there is a large increase from the 7th to the 8th ionisation energy, indicating that the 8th electron is removed from the next inner quantum shell. This means that the element has 7 valence electrons and is in group 17. The element is Chlorine.

Since elements L and M are in the same period and element L has less valence electrons, element L is less electronegative than element M as electronegativity increases across the period. Hence, element L should be the central atom in the compound.

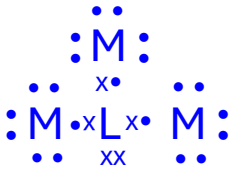
Option A (incorrect): LM_5 is possible as L is in period 3 and have vacant and energetically accesible d orbital to expand its octet structure.



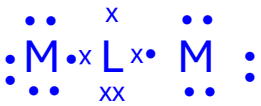
Option B (incorrect): LM_4^+ is possible. Since L is less electronegative than M, the lost of one electron was from element L to form a positively-charged ion.



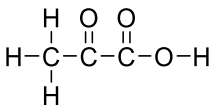
Option C (incorrect): LM_3 is possible as all the atoms fulfil at least an octet structure.



Option D (correct): LM_2 is not possible as the central L atom would be electron-deficient and not fulfil at least an octet structure.



3 The diagram shows the structure of a pyruvic acid.



pyruvic acid

What set of bond angles are present in pyruvic acid?

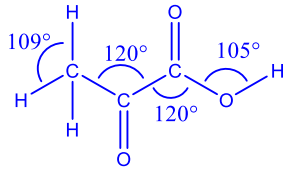
A 120°, 109°, 105°

B 120°, 105°, 90°

C 180°, 120°, 109°

D 180°, 120°, 90°

Answer: A



4 Which statements about water are due to its ability to form hydrogen bonds?

1 Liquid water is denser than ice.

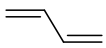
2 Water has a significantly higher boiling point than methane, CH_4, even though both compounds have similar relative molecular masses.

3 The high surface tension of water enables some insects to walk on the surface of the ponds.

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

Answer: A
Option 1 (correct): The hydrogen bonds in ice results in a rigid, highly ordered and open structure where the water molecules are more spaced out as compared to liquid water.
Option 2 (correct): The hydrogen bonds in water is much stronger than the id-id interaction in methane, resulting in a stronger interaction between molecules. More energy is required to break the interaction between molecules and this lead to a higher boiling point.
Option 3 (correct): The strong hydrogen bonds in water do not break when small insects exert a force on it.

5 Synthetic rubber is commonly produced from the monomer buta-1,3-diene.

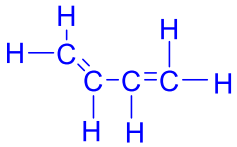


buta-1,3-diene

What are the numbers of σ and π bonds present in one molecule of buta-1,3-diene?

	σ	π
A	6	4
B	7	4
C	8	2
D	9	2

Answer: D



Each single bond is a sigma bond, and each double bond is made up of a sigma and a pi bond.
Hence there are a total of 9 sigma bonds and 2 pi bonds.

6 Which of the following molecules is not polar?

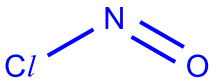
A CCl_3F **B** $NOCl$ **C** SF_4 **D** BF_3

Answer: D

A non-polar molecule have zero overall net dipole moment.

	no. of bond pairs around central atom	no. of lone pairs around central atom	shape	polarity
CCl_3F	4	0	tetrahedral	polar
$NOCl$	2	1	bent	polar
SF_4	4	1	see-saw	polar
BF_3	3	0	trigonal planar	non-polar

Structure of nitrosyl chloride:



7 What is the definition of an Arrhenius base?

A a substance that accepts hydrogen ions

B a substance that donates a pair of electrons

C a substance that produces hydroxide ions in aqueous solution

D a substance that readily reacts with an acid to form a salt and water only

Answer: C
An Arrhenius base dissociates in water to give hydroxide ions by definition.

8 A solid base is added to a small lake to reduce the effects of acid rain. The pH of the water in the lake changes from 4 to 6.

What is the change in $[H^+]$ of the water in the lake?

A It is 100 times smaller.

B It halves.

C It is 100 times greater.

D It doubles.

Answer: A
At pH 4, $[H^+] = 10^{-4}$
At pH 6, $[H^+] = 10^{-6}$
Therefore $[H^+]$ is 100 times smaller.

9 Which row gives the correct expression for K_w and for the K_b of ammonia, NH_3?

	K_w	$K_b(NH_3)$
A	$K_w = [H^+][OH^-]$	$K_b = [H^+][NH_2^-]/[NH_3]$
B	$K_w = [H^+][OH^-]$	$K_b = [OH^-][NH_4^+]/[NH_3]$
C	$K_w = [H^+][OH^-]/[H_2O]$	$K_b = [H^+][NH_2^-]/[NH_3]$
D	$K_w = [H^+][OH^-]/[H_2O]$	$K_b = [OH^-][NH_4^+]/[NH_3]$

Answer: B

$$H_2O(l) \rightleftharpoons H^+(aq) + OH^-(aq)$$

K_w is also known as the ionic product of water.

$$K_w = [H^+][OH^-]$$

$$NH_3(g) + H_2O(l) \rightleftharpoons NH_4^+(aq) + OH^-(aq)$$

K_b is also known as the base dissociation constant. By treating ammonia as a base,

$$K_b = [NH_4^+][OH^-]/[NH_3]$$

10 *Use of the Data Booklet is relevant to this question.*

Which chemical formula is <u>not</u> possible for phosphorous?

A P_4O_6

B P_4O_{10}

C PO_2

D PO_3

Answer: D

Phosphorous is in Group 5 and hence its highest oxidation state is +5.

chemical formula	average oxidation number of phosphorous
P_4O_6	+3
P_4O_{10}	+5
PO_2	+4
PO_3	+6

11 **M** is an element from the third period.

The aqueous chloride of **M** is acidic, and gives a white precipitate when reacted with NaOH(aq). This precipitate dissolves on reacting either with NaOH(aq) or with H_2SO_4(aq).

In which Group of the Periodic Table is **M** likely to be found?

A 1 **B** 2 **C** 13 **D** 14

Answer: C

Option A (incorrect): The aqueous choride of Group 1, NaC*l*, is not acidic.

Option B (incorrect): The hydroxide of Group 2, $Mg(OH)_2$, is not soluble in NaOH(aq).
Option C (correct): The aqueous chloride of Group 13, $AlCl_3$, is acidic.
$[Al(H_2O)_6]^{3+} + H_2O \rightleftharpoons [Al(H_2O)_5(OH)]^{2+} + H_3O^+$
$Al(OH)_3$ is soluble in both NaOH or H_2SO_4.
$Al(OH)_3(s) + NaOH(aq) \rightarrow NaAl(OH)_4(aq)$
$2Al(OH)_3(s) + 3H_2SO_4(aq) \rightarrow Al_2(SO_4)_3(aq) + 6H_2O(l)$
Option D (incorrect): There is no preciptation formed when aqueous chloride of Group 14, $SiCl_4$, reacts with NaOH.

12 *Use of the Data Booklet is relevant to this question.*

The properties of chlorine, bromine (denoted as $\mathbf{X}_2$ in their elemental state) and their compounds are compared.

Which property is smaller for chlorine than for bromine?

A volatility of $\mathbf{X}_2$

B oxidising power of $\mathbf{X}_2$

C first ionisation energy of **X**(g)

D the acid strength of H**X** in aqueous solutions

Answer: D
Option **A** (incorrect): Due to a smaller number of electrons, the instantaneous dipole-induced dipole attraction between Cl_2 molecules is weaker than that between Br_2 molecules and Cl_2 is more volatile (i.e. has a lower boiling point).

Option **B** (incorrect): The oxidising power of Cl_2 is greater than that of Br_2. When undergoing reduction, each halogen atom gains an electron and this electron is added to the valence shell which is nearer to the nucleus for Cl_2 than Br_2. Hence it is easier for Cl_2 to gain the electron due to the greater electrostatic attraction, hence its greater oxidising power.

Option **C** (incorrect): The first IE of Cl(g) is 1260 kJ mol^{-1} while that of Br(g) is 1140 kJ mol^{-1}.

Option **D** (correct): HCl is a weaker acid than HBr due to the smaller atomic radius of Cl than Br, resulting in greater extent of overlap between the orbital of H and the orbitals of Cl and a shorter and stronger H−Cl bond. Hence more energy is needed to overcome H−Cl bond and the extent of dissociation of HCl into H^+ and Cl^- is lower.

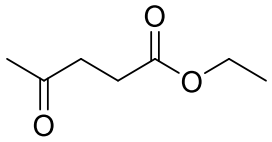
13 There is a change in the radius of an atom when it forms a cation or an anion.

Which changes in radius occur?

	atom to cation	atom to anion
A	decrease	increase
B	decrease	decrease
C	increase	increase
D	increase	decrease

Answer: A
Cation has a smaller radius than its corresponding atom as it has one electronic shell less than the atom. Thus, there is greater effective nuclear charge and a shorter distance between the nucleus and the valence electrons. Hence, there is stronger attraction between the nucleus and the valence electrons, leading to a smaller radius.
Anion has a larger radius than the corresponding atom. Comparing the atom and corresponding anion, both have the same nuclear charge but the shielding effect is slightly larger in the anion due to the repulsion between the electrons in the same shell. Hence there is a weaker attraction between the nucleus and the electrons in the anion leading to a larger radius.

14 Compound **G,** $C_7H_{12}O_3$, is a diesel fuel additive which reduces the amount of soot formed when the fuel burns.



compound **G**

How many moles of oxygen gas are needed to completely combust 1 mol of compound **G**?

A 8.5 **B** 9.0 **C** 9.5 **D** 10.0

Answer: A
Molecular Formula of **G** = $C_7H_{12}O_3$
$C_7H_{12}O_3 + 8.5O_2 \rightarrow 7CO_2 + 6H_2O$

15 Which pairs of enthalpy changes will always have the same sign, both negative or both positive?

1 lattice energy and enthalpy change of neutralisation

2 bond energy and enthalpy change of combustion

3 enthalpy change of formation and lattice energy

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

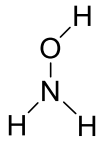
Answer: D
Option 1 (correct): both lattice energy and enthalpy of neutralisation is always negative
Option 2 (incorrect): bond energy is positive while enthalpy of combustion is negative
Option 3 (incorrect): enthalpy of formation can be positive/negative while lattice energy is negative

16 *Use of the Data Booklet is relevant to this question.*

When hydroxylamine reacts with hydrogen peroxide, H–O–O–H, in their gaseous states, the only products are nitrogen gas, $N_2(g)$ and steam, $H_2O(g)$.

$$2NH_2OH + H_2O_2 \rightarrow N_2 + 4H_2O$$

The average bond energy of N–O is 201 kJ mol^{-1}.



hydroxylamine

What is the enthalpy change of reaction when 1.0 mol of hydroxylamine reacts with hydrogen peroxide?

A −336 kJ mol^{-1}

B −672 kJ mol^{-1} (calculated based on 2 mol of NH_2OH)

C +336 kJ mol^{-1} (bond energy of products – bond energy of reactants of option B)

D +672 kJ mol^{-1} (bond energy of products – bond energy of reactants of option A)

Answer: A

Since the enthalpy change of reaction is with respect to 1.0 mol of hydroxylamine, the stoichiometric coefficient of hydroxylamine in the balanced chemical equation needs to be 1.

The balanced chemical equation is $NH_2OH + 0.5H_2O_2 \rightarrow 0.5N_2 + 2H_2O$.

$\Delta H_r = \Sigma$[bond energy of reactants] − Σ[bond energy of products]

ΔH_r = [(2 x 390 + 201 + 460)+0.5(2 x 460 +150)] – [0.5(944)+2(2 x 460)]
= −336 kJ mol^{-1}

17 *Use of the Data Booklet is relevant to this question.*

In which pair does the **second** named compound have a lattice energy that is more exothermic than the first?

A magnesium chloride, sodium chloride

B magnesium oxide, calcium oxide

C potassium chloride, potassium fluoride

D sodium bromide, potassium bromide

Answer: C
Option A (incorrect): For $MgCl_2$ and $NaCl$, Mg^{2+} has double the charge of the Na^+ ion, leading to a more exothermic lattice energy. At the same time, since ionic radius of Mg^{2+} (0.065 nm) is smaller than that of Na^+ (0.095 nm), $MgCl_2$ will have a more exothermic lattice energy.

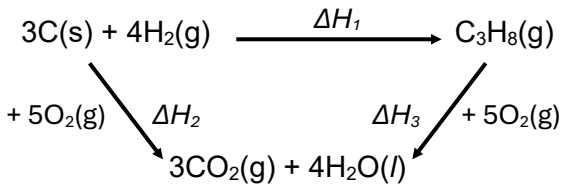
Option B (incorrect): For MgO and CaO, since ionic radius of Mg^{2+} (0.065 nm) is smaller than that of Ca^{2+} (0.099 nm), MgO will have a more exothermic lattice energy.

Option C (correct): For KCl and KF, since ionic radius of F^- (0.136 nm) is smaller than that of Cl^- (0.181 nm), KF will have a more exothermic lattice energy.

Option D (incorrect): For NaBr and KBr, since ionic radius of Na^+ is smaller than that of K^+, NaBr will have a more exothermic lattice energy

18 The burning of fuels to release energy is an everyday occurrence in both the home and industry.

The diagram below shows an energy cycle involving the fuel propane.



Which one of the following statements is **incorrect**?

A ΔH_1 represents the enthalpy change of formation of $C_3H_8(g)$.

B ΔH_2 involves the enthalpy change of formation of $CO_2(g)$ and $H_2O(g)$.

C ΔH_2 involves the enthalpy change of combustion of C(s) and $H_2(g)$.

D ΔH_3 is the sum of ΔH_1 and ΔH_2.

Answer: D
Option A (correct): $\Delta H_f(C_3H_8(g))$: $3C(s) + 4H_2(g) \rightarrow C_3H_8(g)$
Option B (correct):
$\Delta H_f(CO_2(g))$: $C(s) + O_2(g) \rightarrow CO_2(g)$
$\Delta H_c(H_2O(l))$: $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$
Option C (correct):
$\Delta H_c(C(s))$: $C(s) + O_2(g) \rightarrow CO_2(g)$
$\Delta H_c(H_2(g))$: $H_2(g) + \frac{1}{2}O_2(g) \rightarrow H_2O(l)$
Option D (incorrect):
By Hess' Law, $\Delta H_3 = \Delta H_1 - \Delta H_2$

19 Nitrogen(V) oxide undergoes decomposition according to the equation shown.

$$2N_2O_5(g) \rightarrow 4NO_2(g) + O_2(g)$$

The rate equation for this reaction is

$$\text{rate} = k[N_2O_5]$$

At a certain temperature when the initial $[N_2O_5]$ is 3.00 mol dm^{-3}, the half-life is 1100 minutes.

What is the half-life at the same temperature when the initial $[N_2O_5]$ is 1.50 mol dm^{-3}?

A 550 minutes **B** 1100 minutes **C** 2200 minutes **D** 4400 minutes

Answer: B
From the rate equation, it is a first order reaction wrt N_2O_5. The half-life of a first order reaction is constant and independent of its concentration.
Hence, at the same temperature, the half-life is constant at 1100 minutes when the initial $[N_2O_5]$ is either 3.00 mol dm^{-3} or 1.50 mol dm^{-3}.

20 A reaction between R and S produces a gas.

This reaction is first order with respect to R and second order with respect to S. Two experiments were carried out.

In the first experiment, at given concentrations of R and S, 100 cm^3 of gas were produced during the first minute of the reaction.

In the second experiment, under the same external conditions, the initial concentration of R is doubled and that of S is halved.

What volume of gas will be produced in the second experiment, in the first minute of the reaction?

A 25 cm^3 **B** 50 cm^3 **C** 100 cm^3 **D** 200 cm^3

Answer: B
Rate = $k[R][S]^2$
Expt 1:
When given [R] and [S] are used, 100 cm^3 of gas is produced.

Expt 2:
[R] x 2 and [S] ÷ 2 is used, rate ÷ 2.
The new rate will be rate = 2 x $(0.5)^2$ = 0.5 times of the original rate.
Volume of gas produced = 0.5 x 100 = 50 cm^3
Thus only 50 cm^3 of gas will be produced in same amount of time.

21 Which of the following statements describes the effects of a catalyst on a reaction?

1 speeds up the reaction by providing an alternative pathway of lower activation energy.

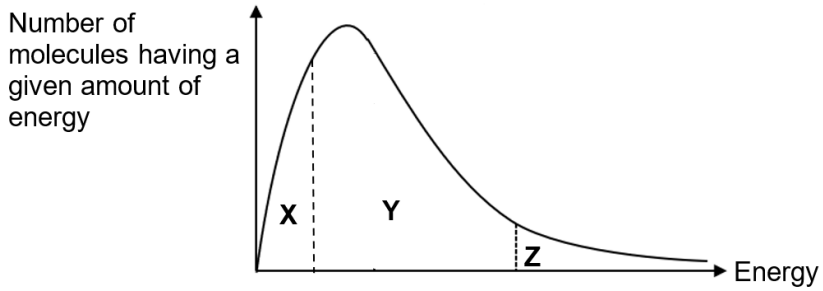
2 increases the rate constant of the reaction.

3 increases the speed at which reacting particles collide with one another.

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

Answer: A
Option 1 (correct): it speeds up the reaction by providing an alternative pathway of lower activation energy.
Option 2 (correct): catalyst lowers the activation energy, which increases the rate constant.
Option 3 (incorrect): an increase in temperature, and not catalyst, increases the kinetic energy of the reacting particles, which then increases the speed at which reacting particles collide with one another.

22 The Maxwell Boltzmann distribution curve shows the number of molecules having a given amount of kinetic energy at a particular temperature.



How would the areas of **Z** and (**X** + **Y** + **Z**) change if the temperature was lowered?

	Z	**X + Y + Z**
A	no change	increase
B	no change	decrease
C	decrease	no change
D	increase	no change

Answer: C

At a lower temperature, the graph will shift to the left hand side and the peak of the graph will be higher than the original. Since there is no change to the number of molecules, the area under both graphs (**X** + **Y** + **Z**) should be the same.

At a lower temperature, the number of molecules with higher kinetics energy will decrease, thus the area of **Z** will decrease.

23 The equation below is the Contact process, which is a reversible exothermic reaction that is involved in the synthesis of sulfuric acid in the industry. The reaction is catalysed by vanadium(V) oxide (V_2O_5) and takes places in an enclosed vessel.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

Which of the following modifications would increase the equilibrium constant, K_c, of the reaction?

1 decrease $[O_2]$

2 add more V_2O_5 catalyst

3 decrease temperature

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

Answer: D

k_c is an equilibrium constant and hence is only affected by temperature.

Statement 1 (incorrect): Decreasing $[O_2]$ affects the position of equilibrium of the reaction but does not affect the value of k_c.

Statement 2 (incorrect): A catalyst lowers the activation energy of the reaction, which affect the rate constant but does not affect the value of k_c.

Statement 3 (correct): By Le Chatelier's Principle, when temperature is decreased, the system will counteract by favouring the forward exothermic reaction to release heat. The position of equilibrium shifts right. The concentration of SO_3 will increase while that of SO and O_2 decreases, increasing the value of k_c.

24 A mixture of 1 mol of chlorine and 2 mol of nitrogen monoxide is allowed to come to equilibrium at a given temperature. The equilibrium mixture contains x mol of chlorine.

$$Cl_2(g) + 2NO(g) \rightleftharpoons 2NOCl(g)$$

What are the amounts of the other constituents of the equilibrium mixture?

	NO / mol	NOCl / mol
A	$2x$	$2x$
B	$2 - 2x$	$2x$
C	$2x$	$2 - 2x$
D	$2 - x$	$2 - x$

Answer: C

	$Cl_2(g)$	$+ 2NO(g)$	$\rightleftharpoons$	$2NOCl(g)$
Initial /mol	1	2		0
Change /mol	$-(1 - x)$	$-2(1 - x)$		$+2(1 - x)$
Eqm /mol	x	$2x$		$+2(1 - x)$

25 Which of the following statements is true about the use of nanoparticles as catalyst?

1 They can be used in smaller quantity compared to traditional heterogeneous catalysts.

2 They are more expensive than traditional heterogeneous catalyst to achieve the same extent of catalytic effect.

3 There is a larger surface area to volume ratio compared to that of traditional heterogeneous catalyst.

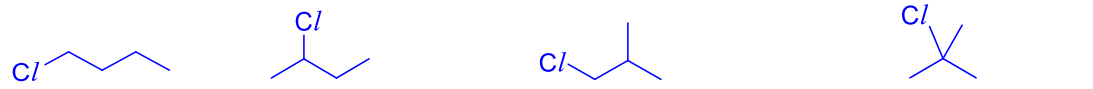
A 1 and 2 only **B** 1 and 3 only **C** 2 only **D** 3 only

Answer: B
Statement 1 (correct): By using nanoparticles, a smaller mass of the metal will be required to produce the same surface area for reactions as compared to the larger particles.
Statement 2 (incorrect): Since less mass of nanoparticles are required, they are cheaper than traditional heterogeneous catalyst to achieve the same extent of catalytic effect.
Statement 3 (correct): The larger surface area to volume ratio is a characteristic of nanoparticles to be used as a catalyst

26 How many constitutional isomers does C_4H_9Cl have?

A 2 **B** 3 **C** 4 **D** 5

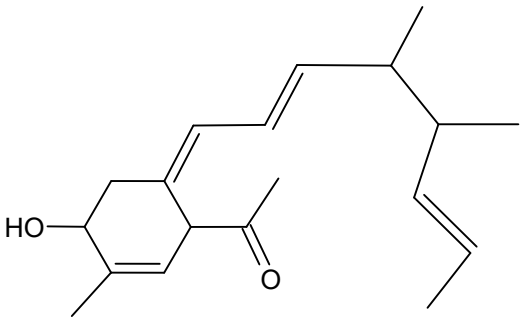
Answer: **C**
Constitutional isomers have the same molecular formula but different constitutional formula, that is, different arrangement of atoms. C_4H_9Cl is a saturated (no double bonds present) halogenoalkane. It can exhibit chain isomerism and positional isomerism.



1-chlorobutane 2-chlorobutane 1-chloro-2-methylpropane 2-chloro-2-methylpropane

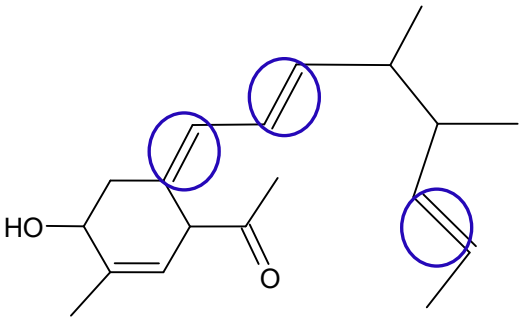
There is a total of **4** constitutional isomers.

27 How many cis-trans isomers does the following molecule have?



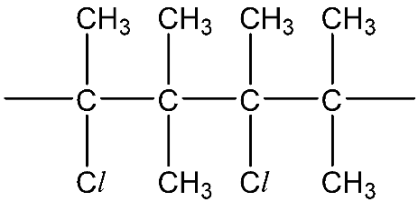
A 4 **B** 8 **C** 16 **D** 32

Answer: B



Cis-trans isomers can only be exhibited by C=C with 2 different atoms/groups of atoms attached to each C of the C=C.
As seen in the diagram above, there are 3 C=C that can exhibit cis-trans isomerism. The C=C in the cyclic ring do not exhibit cis-trans isomerism as they are restricted by the cyclic structure.
Hence, the total number of stereoisomers = $2^{(3)}$ = 8

28 A section of a polymer showing two repeat units is shown below:



Which statements are true about the polymer above?

1 It is an addition polymer.

2 The polymer cannot be broken down by hydrolysis.

3 The monomer is 2-chlorobut-2-ene.

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

Answer: B
Option 1 (correct): the polymer is an addition polymer with its monomer containing an alkene functional group.
Option 2 (correct): the main functional group in the polymer is a halogenoalkane, which cannot undergo hydrolysis to be broken back to its monomer.
Option 3 (incorrect): the alkene is 2-chloro-3-methylbut-2-ene rather than 2-chlorobut-2-ene.

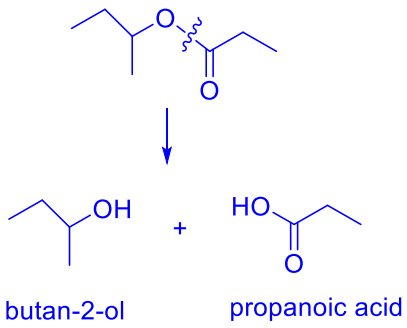
29 The structural formula of X is $CH_3CH_2CH(CH_3)OCOCH_2CH_3$.

X can be made by reacting compounds Y and Z in the presence of concentrated sulfuric acid.

What are the identities of Y and Z?

	Y	Z
A	2–methylbutanoic acid	ethanol
B	3–methylbutanoic acid	ethanol
C	butan–2–ol	propanoic acid
D	butan–3–ol	propanoic acid

Answer: C



butan-2-ol propanoic acid

30 Which property of PVE, poly(vinyl chloride), best explains for its use in raincoats?

A The polymer chains of PVC are closely packed together.

B PVC forms weak hydrogen bonds with water.

C PVC is an addition polymer.

D PVC is a non-polar polymer.

Answer: A
Option A (correct): PVC forms relatively strong permanent dipole–permanent dipole attractions between the long polymer chains. The polymer chains are closely packed together. Hence, water cannot seep into or seep through the PVC material which makes it suitable to be used in raincoats.
Option B (incorrect): PVC does not have any hydrogen atoms bonded to small highly electronegative elements (F, O, N) to be able to form hydrogen bonds with water in the first place.
Option C (incorrect): This is true but does not explain why PVC is suitable for use as raincoat. PVA is also an addition polymer but is not suitable for use as raincoat.
Option D (incorrect): This statement is false as PVC does have an overall net dipole moment due to the polar C-C*l* bond, which enables it to form permanent dipole-permanent dipole interactions between polymer chains.