

TEMASEK JUNIOR COLLEGE
2025 JC2 PRELIMINARY EXAMINATION
Higher 1



CHEMISTRY

8873/01

Paper 1 Multiple Choice

17 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet (OMS)
Data Booklet

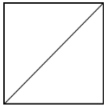
READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.

There are **thirty** 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.

Write your name & Civics Group on the Answer sheet. Shade your index number in the appropriate boxes.

Name	_____		Use only 2B pencil for all entries on this sheet. Shade the bubble completely. Rub out errors thoroughly. Do not make any stray mark on this sheet.
Class	_____		
Test Name	_____		
Subject	_____		

First 2 characters are your class. Next 2 characters are your class index number.
Example:
JC students: write and shade **0501** for CG05 & index number 01.
IP students: write and shade **1A01** for IP1A & index number 01.

Write		Shade appropriate bubbles															
		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Index Number	0	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	3	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

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.

1 An ion, **Q** has the following properties:

- has a noble gas configuration
- has more protons than electrons
- was obtained by removing electrons from the same orbital

Which of the following could be **Q**?

- A** Al^{3+} **B** Ca^{2+} **C** Cu^{2+} **D** S^{2-}

2 Which ion would undergo the greatest deflection in an electric field?

- A** ${}^4\text{He}^{2+}$ **B** ${}^{19}\text{F}^{-}$
C ${}^{14}\text{N}_2^{+}$ **D** ${}^{16}\text{O}_2^{2+}$

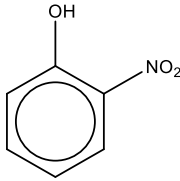
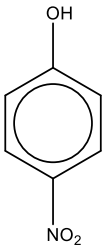
3 An isolated gaseous species has paired electrons in at least one of its 3d orbitals and a fully filled 4s subshell.

What could be the identity of the species?

- A** Cu **B** Mn **C** Fe **D** Fe^{2+}

4 Which of the following **cannot** be explained by hydrogen bonding?

- A** An ice cube floats on water.
B The difference in volatility between pentan-1-ol and hexan-1-ol.

- C** The difference in melting point between  and  .
D The higher than expected relative molecular mass of ethanoic acid in benzene.

- 5 Which one of the following sets of substances includes a giant metallic structure, a giant ionic lattice structure and a simple molecular structure?

- A** Sr, Al_2O_3 , I_2
B Be, Al_2Cl_6 , SO_3
C Al, C, SiO_2
D Ni, PCl_3 , SiCl_4

- 6 Four substances have the physical properties shown.
 Which substance exists as a simple molecular solid at room temperature?

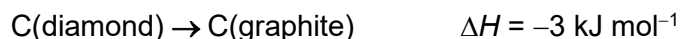
	melting point / °C	electrical conductivity	solubility in water
A	-7	does not conduct	slightly soluble
B	46	does not conduct	insoluble
C	420	conducts	insoluble
D	782	does not conduct	soluble

- 7 Which species contain dative (co-ordinate) bonding?

- 1 CO
 2 N_2H_4
 3 Al_2Cl_6

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

- 8 The conversion of diamond to graphite is exothermic:

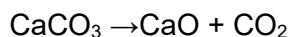


However, the reaction does not occur.

Which statement best explains the above?

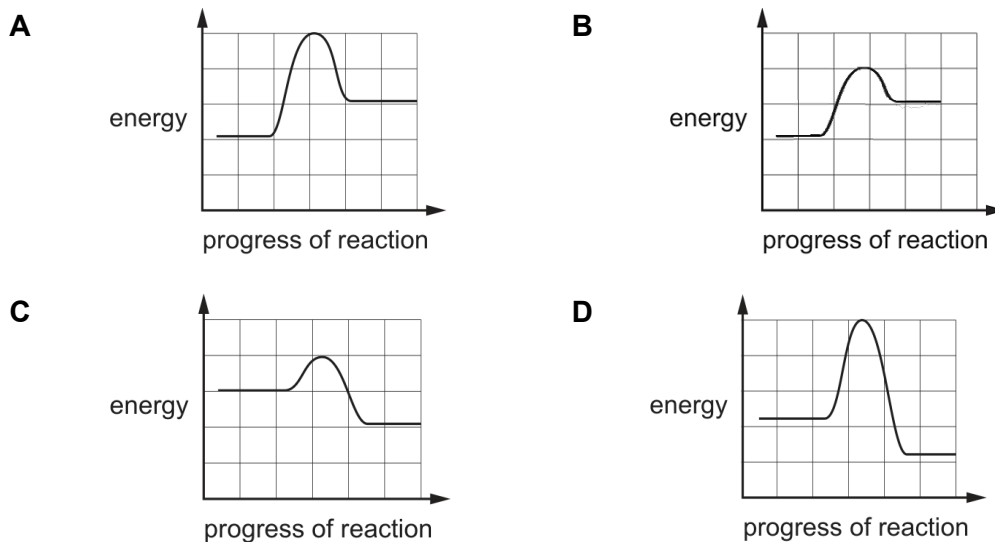
- A** A tetrahedral configuration is always more stable than a planar one.
- B** Diamond has only strong covalent bonds whereas graphite has both covalent bonds and instantaneous dipole-induced dipole interactions.
- C** The change from diamond to graphite has a high activation energy.
- D** The bond angle for diamond is smaller than that of graphite.
- 9 When 10 cm³ of a gaseous hydrocarbon was sparked with 100 cm³ oxygen gas and cooled to room temperature, the gaseous mixture contracted to 80 cm³. When the residual gas was passed through aqueous potassium hydroxide, there was a further contraction of 40 cm³.
- What is the identity of the hydrocarbon?
- A** 2-methylpropene
- B** propane
- C** butadiene
- D** butane
- 10 Which species contains a different number of electrons from the other three?
- A** ClO_4^-
- B** H_2SO_4
- C** SO_4^{2-}
- D** Sn^{2+}

- 11 Group 2 carbonates such as calcium carbonate decompose thermally to give the metal oxide and carbon dioxide gas.

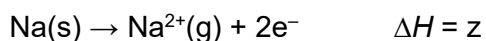
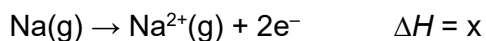
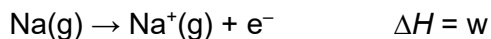


The numerical values of the enthalpy change of the reaction and activation energy are 178 kJ mol^{-1} and 356 kJ mol^{-1} , respectively.

Which reaction pathway diagram best represents this reaction?



- 12 Equations involving three enthalpy changes are shown.



Which expression represents the second ionisation energy of sodium?

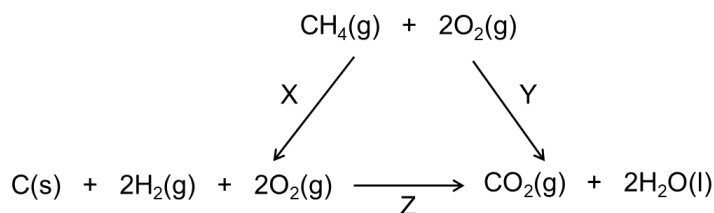
A $2w$

B $x - w$

C x

D z

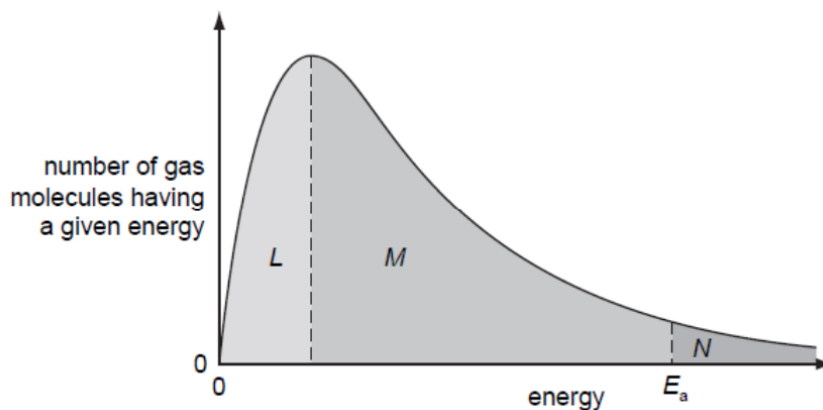
- 13 An energy cycle is shown.



The standard enthalpy changes involved are X, Y and Z.

The numerical value of standard enthalpy change Y and Z are 890 and 964, respectively. Which of the three values are negative?

- A** X and Z only **B** X only
C Y and Z only **D** Y only
- 14 The Boltzmann distribution shows the number of molecules having a particular energy at constant temperature.

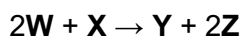


Which of the following statements are correct?

- 1 The maximum of the curve shifts to the right when the temperature is raised.
- 2 The E_a decreases when the temperature increases.
- 3 Lowering the temperature will decrease the total areas labelled L, M and N.

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

- 15 The kinetics of a reaction was investigated, and the following results were obtained.



run	[W] / mol dm ⁻³	[X] / mol dm ⁻³	initial rate / mol dm ⁻³ s ⁻¹
1	0.020	0.015	6.40×10^{-3}
2	0.020	0.030	2.56×10^{-2}
3	0.030	0.030	3.84×10^{-2}

What is the numerical value of the rate constant for this reaction?

- A** 0.213 **B** 0.320 **C** 21.3 **D** 1420
- 16 Bromine and methanoic acid react as follows

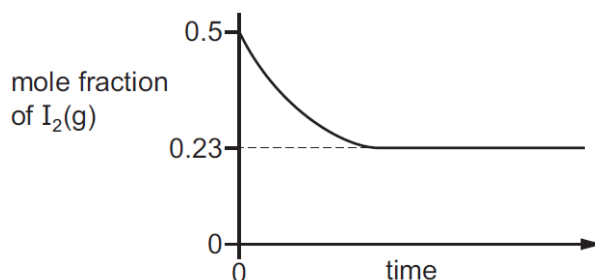
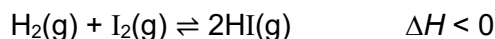


In one experiment, the concentration of Br₂(aq) and HCOOH(aq) used are equal. The rate of reaction is found to be first order with respect to both bromine and to methanoic acid.

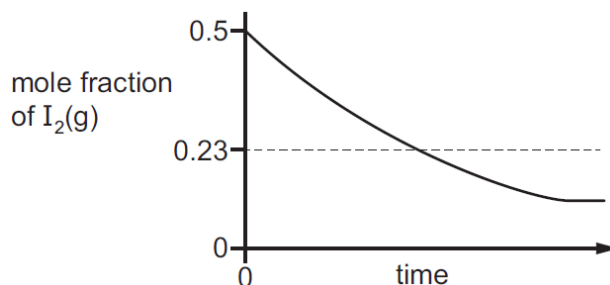
Which of the following statements about the above reaction is correct?

- A** The units of the rate constant is s⁻¹.
- B** The half-life of the reaction is constant.
- C** The rate of formation of H⁺(aq) is half the rate of disappearance of Br₂(aq).
- D** Doubling the concentration of methanoic acid doubles the rate of evolution of gas.

- 17 Equal amounts of $\text{H}_2(\text{g})$ and $\text{I}_2(\text{g})$ are mixed and the composition of the mixture is monitored. A graph of the results is shown below.



The experiment is repeated with a change in condition and the following graph of results is obtained.



Which of the following is a possible change made in the second experiment?

- A A catalyst is used in the second experiment.
 - B $\text{H}_2(\text{g})$ and $\text{I}_2(\text{g})$ are mixed in a ratio of 2 : 1 in the second experiment.
 - C The second experiment is conducted at a higher pressure compared to the first experiment.
 - D The second experiment is conducted at a lower temperature compared to the first experiment.
- 18 Which of the following statements about the properties of Group 1 elements down the group is correct?
- A The reducing power increases.
 - B The reactivity with water decreases.
 - C The strength of metallic bond increases.
 - D The electronegativity of elements increases.

- 19** **X**, **Y** and **Z** represent elements in the Periodic Table.

The first ionisation energy of **X** is greater than the first ionisation energy of **Y**.

The melting point of **Z** is higher than that of **Y**.

Which row shows the possible identities of **X**, **Y** and **Z**?

	X	Y	Z
A	N	P	Al
B	B	Al	P
C	Ga	Al	P
D	As	P	Al

- 20** Which statement about the halogens or halide ions is correct?

- A** Chloride ions are stronger reducing agents than iodide ions.
- B** Bromine does not oxidise chloride ions when added to sodium chloride solution.
- C** The volatility of the halogen increases down the group.
- D** The thermal stability of the hydrogen halides increases down the group.

- 21** A 2 dm³ solution was made by mixing 0.0025 mol of HCl(aq) and 0.0040 mol of NaOH(aq).

What was the pH of the resulting solution?

- A** 2.82 **B** 3.13 **C** 10.9 **D** 11.2

- 22** The table below shows the values of the ionic product of water, K_w , at two different temperatures.

Temperature / °C	K_w / mol ² dm ⁻⁶
25	1.00×10^{-14}
62	1.00×10^{-13}

Which of the following statements are correct for pure water?

- 1 The dissociation of water is an endothermic process.
- 2 At 62 °C, the pH value is less than 7.
- 3 At 62 °C, pure water is acidic.

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

- 23** Crude oil is a mixture of different kinds of hydrocarbons including alkanes. The alkanes in crude oil can be separated because of the difference in their boiling points.

The table below shows the boiling points of three alkanes.

alkane	boiling point / °C
pentane	36
2-methylbutane	28
dimethylpropane	10

Which of the explanation best explains the difference in the boiling points observed?

- A** The boiling point is dependent on the size of the electron cloud.
B Increased branching on a carbon chain increases the boiling point.
C Reduced branching increases the polarity of the alkane molecules.
D Increased branching reduces the strength of the intermolecular instantaneous dipole-induced dipole attractions.

- 26** Butan-1-ol and butan-2-ol are constitutional isomers of each other.

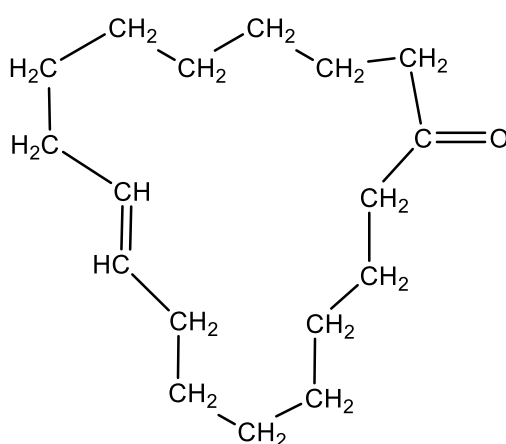
Butan-1-ol can be made by reducing compound **W** with LiAlH_4 .

Butan-2-ol can be dehydrated to form **X** and **Y**, which are constitutional isomers of each other.

Which row is correct?

	functional group present in W	exhibits cis-trans isomerism
A	aldehyde	either X or Y
B	carboxylic acid	both X and Y
C	aldehyde	both X and Y
D	ketone	either X or Y

- 27** The naturally-occurring molecule civetone, $\text{C}_{17}\text{H}_{30}\text{O}$, is found in a gland of the African civet cat and has been used in perfumery.



civetone

Which statements about civetone are correct?

- 1 It contains alkene and ester functional groups.
- 2 It reacts with Br_2 in CCl_4 to form a product with molecular formula, $\text{C}_{17}\text{H}_{32}\text{OBr}_2$.
- 3 Hydrogen bonding does not exist between molecules of civetone.

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

- 28 Platinum nanoparticles are used in catalytic converters to remove harmful air pollutants in the atmosphere.

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

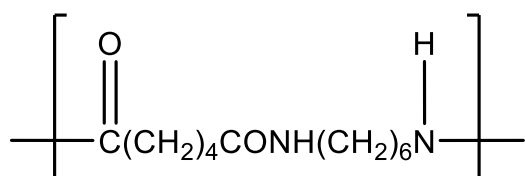
- A Platinum nanoparticles act as heterogeneous catalyst.
- B Platinum nanoparticles are used as a catalyst due to their large surface area to volume ratio.
- C Platinum nanoparticles react with carbon monoxide to form carbon dioxide and platinum oxide.
- D A spherical platinum nanoparticle with a diameter of 5 nm contains fewer active sites for catalysis compared to that with a diameter of 10 nm.

- 29 Which statements about low density poly(ethene) (LDPE) and poly(vinyl chloride) (PVC) are correct?

- 1 Their empirical formula is the same as their monomers.
- 2 LDPE is water resistant while PVC is water soluble.
- 3 PVC is a thermoset while LDPE is a thermoplastic.

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

- 30 The repeating unit of a polymer is shown.



The polymer can be made from its monomers in the presence of **X**.

Which statement is correct?

- A One of the monomers is $\text{HOOC(CH}_2)_4\text{CONH}_2$.
- B The polymer is less prone to creasing than PET.
- C **X** could be DCC.
- D A container for storing alkaline cleaning solutions can be made of this polymer.

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